Chapter 12
Terrestrial Biological Resources

12.0 Readers' Guide and Summary

12.0.1 Overview

Chapter 12 is organized much like the other chapters in this document, but because of the chapter's much greater scope, this guide is provided to help the reader navigate through the various components of the chapter.

The chapter is divided into three main sections.

- 12.1, *Environmental Setting/Affected Environment*
- 12.2, *Regulatory Setting*
- 12.3, *Environmental Consequences*

These sections parallel the same sections in other resource chapters. However, the complexity of the environmental analysis warrants further discussion.

12.0.1.1 Relationship of Chapter 12 to the BDCP and California WaterFix Effects Analyses

The Draft BDCP approaches conservation at the natural community level, using specific biological goals and objectives for species to guide the conservation such that the effects of the plan offset any impacts as well as contribute to recovery of the species. Under the California WaterFix BA, the approach to conservation shifts from a natural community–level approach (i.e., habitat conservation plan [HCP]) to a species-level approach (i.e., Section 7)—in other words, from a top-down approach to a bottom-up approach. This approach is suitable and expected for a BA, as well as most NEPA/CEQA documents; however, because of the mix of alternatives of BDCP and non-HCP approaches, Chapter 12 maintains a relatively parallel approach in order to compare the effects of the non-HCP alternatives to those of the HCP alternatives.

For the BDCP alternatives, effects were evaluated using an analysis of the natural communities, consistent with an HCP approach. Under NEPA, each alternative must be considered and discussed at a comparable level of detail. To ensure comparability among the alternatives, including the non-HCP alternatives, the same approach was used for Alternatives 4A, 2D, and 5A in the EIR/EIS.

The BA analysis relies on updated models for giant garter snake, vernal pool crustaceans, and tricolored blackbird, which have been largely updated due to the more refined wetland delineation data available for the DHCCP Conveyance Planning Area (see Section 12.3.2.4) consistent with the footprint for the proposed action, which does not include largescale restoration. The DHCCP Conveyance Planning Area only covers the area that contains all of the infrastructure for the different water conveyance facility alternatives and thus does not include the entire Plan Area evaluated for the BDCP alternatives. Also, the BA only quantifies the effects of the water conveyance facility impacts where the EIR/EIS includes the quantification of restoration effects on terrestrial biological resources. Because of this limitation to the updated models, they could not be used for the EIR/EIS. In reviewing the analysis in the BA, none of the CEQA or NEPA conclusions would change if theses updated models were used for the EIR/EIS.

As discussed in Section 3.3.2.2, *Non-HCP Alternative Environmental Commitments*, of Chapter 3, much as the Conservation Measures in the BDCP alternatives are meant to satisfy ESA Section 10 and the NCCPA, the Environmental Commitments and associated acreages of protection and restoration are intended to satisfy CEQA, NEPA, and CESA Section 2081, and ESA Section 7 for Alternative 4A and the other non-HCP Alternatives. However, for Alternative 4A or other non-HCP Alternatives, the final acreages of protection and restoration for state and federally listed species addressed in the CESA Section 2081 and ESA Section 7 documents will ultimately be defined in those respective permits; therefore, the final acreages of natural community protection and restoration may differ from those presented in Table 3-9 *Environmental Commitments under Alternative 4A* in Chapter 3 of the EIR/EIS. The final protection and restoration acreages for impacts on natural communities and terrestrial species may be adjusted, as appropriate, based on the final mitigation requirements of the CESA and ESA process, which includes site-specific confirmation of species habitat acreages for those species covered under those permits.

12.0.2 Environmental Setting/Affected Environment

The *Environmental Setting/Affected Environment* section introduces the reader to historic trends in biodiversity of the study area, then describes the resources considered in each alternative's analysis, as summarized below.

12.0.2.1 Natural Communities

The natural communities listed below are found within the terrestrial biology study area and are described in the *Environmental Setting/Affected Environment*. For simplicity, Cultivated Lands and Developed Lands, which are not natural communities but provide habitat for terrestrial species, are included in the Natural Communities category. No in-depth analysis was conducted of those two land cover types, but their value is addressed in the species-level analyses.

- Tidal Perennial Aquatic
- Tidal Brackish Emergent Wetland
- Tidal Freshwater Emergent Wetland
- Valley/Foothill Riparian
- Nontidal Perennial Aquatic
- Nontidal Freshwater Perennial Emergent Wetland
- Alkali Seasonal Wetland Complex
- Vernal Pool Complex
- Managed Wetland
- Other Natural Seasonal Wetland
- Grassland
- Inland Dune Scrub

- Cultivated Lands
- Developed Lands

Many of the natural communities are aquatic in nature, but they are considered in this chapter in the context of their habitat values to terrestrial biological resources. Fish and other aquatic species are considered in Chapter 11, *Fish and Aquatic Resources*.

12.0.2.2 Special-Status Species

Although the BDCP focuses on 45 covered terrestrial wildlife and plant species, these constitute a subset of a considerably larger number of special-status wildlife and plant species analyzed in the EIR/EIS pursuant to NEPA and CEQA (a total of 149 species). For this analysis, no organizational distinction has been made between covered and noncovered species. However, as described in detail in Section 12.3.2, *Methods for Analysis*, the analysis of effects on covered species is derived from the analysis conducted for the BDCP as detailed in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the Draft BDCP.[1] Species-specific habitat models were developed for the BDCP analysis; this level of modeling was not developed for noncovered species. The special-status species addressed in this chapter are listed in Tables 12-2 and 12-3.

12.0.3 Environmental Consequences

This EIR/EIS analyzes 19alternatives, including the No Action Alternative. Many of the alternatives would have identical or very similar effects on terrestrial biological resources. Accordingly, this section presents detailed analyses of five alternatives (Alternatives 1A, 1B, 1C, 4, 4A, and 9) that would have varying effects associated with their significantly different footprints for the water conveyance facilities. The other action alternatives (Alternatives 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, 2D, and 5A) are analyzed in a comparative, summary fashion, focusing on the slight differences in effect as compared with the effects of the six alternatives analyzed in detail.

Impacts are numbered consecutively beginning with Impact BIO-1 for each alternative. The numbering proceeds through each community and species to Impact BIO-186. Impacts BIO-187 through BIO-191 are discussed only at the very end of the chapter, in Sections 12.3.5, *Cumulative Effects*, and Section 12.3.6, *Effects on Other Conservation Plans*.

The alternatives are broken into the BDCP alternatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), and non-HCP alternatives associated with the California WaterFix (2D, 4A, and 5A). The former include conservation measures, while the WaterFix alternatives are not associated with a habitat conservation plan (HCP) and therefore only include Environmental Commitments. The BDCP itself amounts to a series of 21 numbered conservation measures, and nearly all BDCP actions would stem from these conservation measures. Of primary importance in this chapter are Conservation Measure (CM) 1, which regards construction and operation of water conveyance facilities, and ten conservation measures (CM2–CM11) that focus on or that would otherwise effect terrestrial habitat. In this chapter, these actions are identified by proper name (e.g., *CM4 Tidal Natural Communities Restoration*), by the activity involved (e.g., tidal habitat restoration) or simply by conservation measure number (e.g., CM4). The actions under CM2–CM11 are also often called restoration,

[1] As described in Chapter 1, *Introduction*, Section 1.1, the Final EIR/EIS includes the 2013 Draft EIR/EIS, BDCP, 2015 RDEIR/SDEIS, and all associated appendices with these documents; as well as revisions to these documents as contained in this Final EIR/EIS.

protection, management, or enhancement activities. Meanwhile, Alternatives 4A, 2D, and 5A take a different approach to achieve the applicable regulatory standards under Section 7 of the Endangered Species Act (ESA) and Section 2081(b) of the California Endangered Species Act (CESA) while also complying with NEPA and CEQA. A subset of those activities proposed in the conservation strategy for the BDCP would still be implemented under the non-HCP alternatives – specifically, portions of the actions proposed under CM3, CM4, CM6, CM7, CM8, CM9, CM10, CM11, CM12, CM15, and CM16. However, these activities would not be “conservation measures.” The term “conservation measure” is often used in the context of HCPs under Section 10(a)(2) of the ESA and Natural Community Conservation Plans (NCCPs) under the Natural Community Conservation Planning Act (NCCPA). Because Alternative 4A contemplates ESA compliance through Section 7 of the ESA and Section 2081 of CESA, different terminology has been adopted to reflect the difference in permitting strategies under state and federal endangered species laws. These repackaged and limited elements of the original BDCP Conservation Measures are instead referred to as Environmental Commitments. To minimize confusion, they are numbered to track the parallel BDCP Conservation Measures: Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16, as summarized in Table 3-17.

The addition of Alternatives 4A, 2D, and 5A requires a new No Action Alternative to be defined that matches the time horizon for the non-HCP alternatives and provides a baseline or point of comparison for NEPA purposes. The BDCP alternatives use the No Action Alternative Late Long Term (LLT) while the non-HCP alternatives use the No Action Alternative Early Long Term (ELT). The No Action Alternative (ELT) includes most of the assumptions used for the No Action Alternative Late Long Term (LLT) as described in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions,* including continued State Water Project (SWP)/Central Valley Project (CVP) operational assumptions used in CALSIM II modeling and on-going programs, projects and polices that would continue in the absence of action alternatives. Two exceptions include planned Yolo Bypass improvements and habitat restoration required by the U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BiOp). Because Alternatives 4A, 2D, and 5A do not include these Yolo Bypass and habitat restoration actions they are now assumed for the No Action Alternative (ELT); they are actions that would be required to occur with or without implementation of Alternatives 4A, 2D, or 5A. Other programs, projects, and policies assumed for the No Acton Alternative (LLT) are also assumed for the No Action Alternative (ELT) but the ELT period assumes a shorter time horizon of approximately 15 years following project approval. These programs, projects and policies are presented in Tables 3D-1 and 3D-2 in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*, and include those with clearly defined management and/or operational plans, including facilities under construction as of February 13, 2009.

12.0.4 Organization of Resources

Under each alternative, the biological resources are organized in the order shown below.

- **Natural Communities.** This heading is followed by a subheading for each of the communities listed above.
- **Wildlife Species.** Species are listed in taxonomic order: invertebrates, amphibians, reptiles, birds, and mammals. In some cases, where multiple species would be subject to the same or very similar impacts, several species are grouped together (e.g., nonlisted vernal pool invertebrates, least Bell’s vireo and yellow warbler, Cooper’s hawk and osprey).

- **Plant Species.** Plant species are grouped together by natural community (e.g., vernal pool plants, tidal wetland plants).
- **General Terrestrial Biology Effects.** This category examines the following resource topics.
  - Wetlands and Other Waters of the United States.
  - Shorebirds and Waterfowl.
  - Common Wildlife and Plants.
  - Invasive Plant Species.
  - Compatibility with Plans and Policies.

The cumulative effects analysis and the review of action alternatives consistency with other habitat conservation plans/natural community conservation plans for all alternatives are provided in Sections 12.3.5, *Cumulative Effects*, and Section 12.3.6, *Effects on Other Conservation Plans*.

12.0.5 Organization of Impacts

Each impact is presented as a NEPA analysis, using the appropriate terminology for presence or absence of adverse effects. A NEPA effects conclusion is included at the end of the NEPA evaluation. This analysis is followed by a CEQA conclusion, which is identified as such. The CEQA conclusion uses the terminology appropriate to describing the presence or absence of significant impacts. Where impacts are further divided into two timeframe conclusions—near-term and late long-term—these subheadings appear in both the NEPA and the CEQA analyses. The near-term effects, which would occur over the first 10 years of project implementation, are addressed separately because they relate primarily to construction of the water conveyance facilities. For the BDCP alternatives, effects that would result from CM1 are analyzed at a project level, while the late long-term effects are those associated with all actions that would occur over the 50-year timeframe of the BDCP. For the non-HCP alternatives, the entire project (construction, operations and maintenance) is evaluated at a project level. The effects of the Environmental Commitments were evaluated at a programmatic level because no details were available at the time of EIR/EIS preparation regarding specific locations of restoration and protection actions.

12.0.6 Summary of Effects

Chapter 12 is lengthy due to the large number of alternatives analyzed and the large number of special-status plants and wildlife that are addressed. This summary has been prepared to highlight the major effects of the action alternatives, primarily in tabular form, and to provide a method of comparing effects of the action alternatives. The No Action Alternative is discussed in a brief narrative without quantitative comparisons. The differences in effects that would be created by the alternatives are determined primarily by the location, capacity, and design of water conveyance facilities and the amount and type of habitat restoration and enhancement proposed under the BDCP. Table 3-1 in Chapter 3, *Description of Alternatives*, provides a brief overview of the action alternatives.

The major differences the alternatives have in water conveyance facilities and restoration/ enhancement elements are summarized below. This discussion is followed by a discussion of the differences in effects the alternatives would have on natural communities, jurisdictional wetlands and other waters, and special-status wildlife and plant species. All of the discussions of wildlife and plants in this summary section focus solely on special-status species, which are defined as species that are protected by federal or state law or species that are considered sensitive by federal, state, or local resource agencies. See Section 12.1.3, *Special-Status Species*, for a comprehensive definition.

12.0.6.1 Differences among the Alternatives

Pipeline/Tunnel Designs

Alternatives 1A, 2A, 3, 4, 5, 6A, 7, 8, 2D, 4A, and 5A would all use a pipeline/tunnel design to convey water. With the exception of Alternatives 5, 7, 2D, 4A, and 5A, they would have the same habitat restoration and enhancement program. The BDCP alternatives include habitat restoration and enhancement under the conservation measures. The non-HCP alternatives (2D, 4A, and 5A) include habitat restoration under Environmental Commitments. The alternatives differ in capacity to divert water from the north Delta; therefore, they would have different numbers of intakes: Alternatives 1A, 2A, 6A, and 2D each would convey up to 15,000 cubic feet per second (cfs) of Sacramento River flow from the north Delta to Clifton Court Forebay, and each alternative would use five intakes on the eastern bank of the river. Effects of Alternatives 1A, 2A, 6A, and 2D on terrestrial biological resources would be similar. However, while Alternatives 1A, 2A, and 6A include up to 65,000 acres of tidal wetland restoration, Alternative 2D only includes up to 300 acres of tidal wetland restoration, as described in Section 3.5.19 of Chapter 3, *Description of Alternatives*.

Alternatives 4, 7, 8, and 4A would convey up to 9,000 cfs of Sacramento River flow in tunnels and would use three intakes on the eastern bank of the river. Alternatives 4 and 4A were designed to maximize the use of public lands and minimize the size of the forebay in the north Delta; therefore, Alternatives 4 and 4A conveyance facilities would have a somewhat different location than Alternative 7 or 8 facilities. Alternatives 4 and 4A would place reusable tunnel material (RTM, the material generated by excavating the water conveyance tunnels) in 6-foot high storage sites, while all other alternatives are assumed to place the material in 10-foot high storage sites (see Chapter 3, Section 3.6.1.2, *Conveyance Facilities*, for further details). Use of 10-foot-high RTM storage sites could substantially reduce effects in storage site areas under Alternatives 4 and 4A. Alternative 4 includes up to 65,000 acres of tidal wetland restoration, while Alternative 4A only includes up to 295 acres of tidal wetland restoration, as described in Section 3.5.18 of Chapter 3, *Description of Alternatives*. Alternatives 7 and 8 would have identical conveyance facility footprints, but Alternative 7 would include an additional 20 linear miles of channel margin habitat enhancement on Delta waterways and 10,000 acres of additional seasonally inundated floodplain restoration along south Delta rivers.

Alternative 3 would have a capacity to divert 6,000 cfs of Sacramento River flow and would use two eastern bank intakes, and Alternatives 5 and 5A would divert 3,000 cfs using one eastern bank intake. Tidal habitat restoration would be limited to 25,000 acres under Alternative 5, compared with the 65,000 acres for all other alternatives. Tidal restoration under Alternative 5A includes up to 55 acres of tidal wetland restoration, as described in Section 3.5.20 of Chapter 3, *Description of Alternatives*.

Other Designs

Alternatives 1B, 2B, and 6B would use five intakes on the eastern bank of the Sacramento River to divert 15,000 cfs of Sacramento River flow into a canal on the eastern edge of the Delta that feeds into Clifton Court Forebay. These alternatives would have the same restoration and enhancement program as all alternatives except Alternatives 5, 7, 2D, 4A, and 5A. Alternatives 1B, 2B, and 6B would have similar effects on terrestrial biological resources.

Alternatives 1C, 2C, and 6C would use five intakes on the western bank of the Sacramento River to divert 15,000 cfs into a new canal and tunnel system on the western edge of the Delta. These alternatives would have the same restoration and enhancement program as all alternatives except Alternatives 5, 7, 2D, 4A, and 5A. Alternatives 1C, 2C, and 6C would have similar effects on terrestrial biological resources.

The separate corridors design of Alternative 9 would include construction of two screened intakes on the Sacramento River near Walnut Grove, operable barriers and other water control structures within Delta waterways, and dredging of Middle River and Victoria Canal to create facilities that would convey 15,000 cfs of water across the Delta to the export pumps using existing channels. Delta fish migration corridors would be separated from water diversion flows. Alternative 9 would have the same restoration and enhancement program as all alternatives except Alternatives 5, 7, 2D, 4A, and 5A.

12.0.6.2 Comparison of the Effects of the Alternatives

Effects on Natural Communities and Cultivated Lands

Implementing the alternatives would affect natural communities and cultivated lands in two primary ways. Large acreages of natural communities would be permanently eliminated by the construction of water conveyance facilities. These lands would no longer be available as plant and wildlife habitat. Even larger acreages of natural communities would be lost through conversion from one habitat type to another as part of restoration activities; these lands would not be lost as wildlife habitat, but the mix of habitats in the study area would be substantially modified. To fully understand the effects of the alternatives, the permanent losses and conversions must be considered in combination.

Losses Resulting from Construction of Facilities and Conversion Associated with Restoration

Natural community acreages that would be permanently or temporarily lost or converted by implementation of the action alternatives are summarized in Table 12-ES-1. Generally speaking for the action alternatives, the east alignment alternatives (1B, 2B, and 6B) would have the largest effect on terrestrial natural communities (91,725–92,301 acres), depending on the intakes involved) because of their large water conveyance canal. The west alignment alternatives (1C, 2C, and 6C) would have a smaller overall effect (86,961–86,966 acres). The effects of the pipeline/tunnel alternatives other than Alternative 5 (1A, 2A, 3, 4, 6A, 7 and 8) would be smaller still (76,600–80,305 acres). The separate corridors alternative (9) would have a slightly smaller overall effect than most of the pipeline/tunnel alternatives (74,413 acres). Alternative 5, which is also a pipeline/tunnel alternative, would have an even smaller effect (40,989 acres) of all the action alternatives because of its much smaller tidal restoration goal. Alternatives 2D, 4A, and 5A would have the smallest effects because of much smaller tidal restoration goals (8,967 acres under Alternative 2D; 8,276 acres under Alternative 4A; and 7,623 acres under Alternative 5A).

Differences among the pipeline/tunnel alternatives result mainly from differences in the amount of restoration. The largest loss or conversion of acreage for restoration would occur under Alternative 7, which would include 10,000 additional acres of floodplain restoration; Alternative 5 would have a smaller effect because it would restore 40,000 fewer acres of tidal habitat. The non-HCP alternatives introduced in the RDEIR/SDEIS (2D, 4A, and 5A) would have much smaller impacts on biological resources because they are not presented as HCP/NCCPs with large amounts of restoration over a 50-year period, and would restore less than 300 acres of tidal habitat.

The location of the conveyance facilities determines the type of effect on natural communities. The west alignment facilities would be located in the western Delta, including areas west of Clifton Court Forebay where the facilities would affect substantially greater alkali seasonal wetland complex acreage than the other alternatives would affect. The alkali seasonal wetland complex natural community affected by the west alignment alternatives would be 88–94 acres, while the range for the other BDCP alternatives would be 59–73 acres (Table 12-ES-1). Alternatives 2D, 4A, and 5A would include 2 acres of alkali season wetland complex. Acreages of effects on other natural community types are broadly overlapping among east alignment, west alignment, and pipeline/tunnel alternatives, with generally smaller effects under the pipeline/tunnel alternatives, and much smaller effects under the non-HCP alternatives. The exception would be Alternative 7 because of its 10,000 acres of additional seasonally inundated floodplain restoration.

Among the pipeline/tunnel alternatives, Alternative 7 would have the largest effect on the valley/foothill riparian, nontidal perennial aquatic, and grassland natural communities and cultivated lands because of its additional 10,000 acres of restoration. Alternative 4 would have the largest effect of the pipeline/tunnel alternatives on tidal perennial aquatic, tidal freshwater emergent wetland, nontidal freshwater perennial emergent wetland, alkali seasonal wetland complex, and vernal pool complex natural communities because RTM storage sites would be 6 feet high instead of 10 feet high as in all other alternatives (see Chapter 3, Section 3.6.1.2, *Conveyance Facilities*), and because of additional RTM storage facilities near Clifton Court Forebay, where vernal pool complex and alkali seasonal wetland complex natural communities would be affected. Of the pipeline/tunnel alternatives, Alternative 5, which would have a smaller restoration area and only one water intake, would have the smallest effect on the valley/foothill riparian, nontidal perennial aquatic, and grassland natural communities and cultivated lands (Table 12-ES-1). Alternative 5 would also provide a smaller benefit to tidal wetland habitats because of the alternative's smaller tidal marsh restoration area. Alternatives 2D, 4A, and 5A would provide some of the least benefits to tidal wetland habitats with 9–11 acres. These non-HCP alternatives would also provide the least benefits to tidal perennial aquatic, nontidal freshwater perennial emergent wetland, alkali seasonal wetland complex, vernal pool complex natural communities, and grassland.

Alternative 9 would have a smaller effect on cultivated lands than all other action alternatives other than Alternative 5 would have. However, Alternative 9 would have the largest effect on tidal perennial aquatic, tidal freshwater emergent wetland, valley/foothill riparian, and nontidal freshwater emergent wetland natural communities. These Alternative 9 losses would be primarily temporary and associated with the initial dredging of Middle River and Victoria Canal to improve their flow capacity.

Under the No Action Alternative, there would be no water conveyance facilities construction effects on natural communities. Also, there would be no restoration, protection, and enhancement of natural communities resulting from the other conservation measures, or Environmental Commitments under the non-HCP alternatives. Several programs that are under way or in the planning stages to increase wetlands and riparian natural communities in the absence of a BDCP or California WaterFix project will benefit natural communities and increase wildlife-friendly agriculture in the study area. The potential exists for levee deterioration and repairs, global climate change and associated sea level rise, and seismic activity that damages levees to result in substantial loss of terrestrial natural communities and cultivated land habitats.

Table 12-ES-1. Direct Effects of Alternatives on Natural Communities and Cultivated Lands in the Terrestrial Biological Resources Study Area (acres)[a]

Alternative[c]	Natural Community Type/Cultivated Land[b]											
	Tidal Perennial Aquatic	Tidal Freshwater Emergent Wetland	Valley/ Foothill Riparian	Nontidal Perennial Aquatic	Nontidal Freshwater Perennial Emergent Wetland	Alkali Seasonal Wetland Complex	Vernal Pool Complex	Managed Wetland	Other Natural Seasonal Wetland	Grassland	Cultivated Land	Total
1A	224	21	892	290	128	72	375	13,899	0	2,907	58,369	77,178
1B	221	27	896	293	137	72	375	13,838	0	3,087	72,778	91,725
1C	186	9	932	311	131	94	437	13,959	4	3,007	67,895	86,966
2A	232	20	893	290	128	72	375	13,899	0	2,923	58,875	77,708
2B	249	33	910	293	138	72	375	13,840	0	3,117	73,273	92,301
2C	186	9	932	311	131	88	437	13,959	4	3,008	67,895	86,961
2D[d]	285	9	78	63	4	2	47	126	0	673	7,679	8,967
3	184	18	873	290	128	72	375	13,899	0	2,869	57,891	76,600
4[d]	308	20	868	333	131	73	394	13,855	0	2,954	58,379	77,315
4A[d]	280	11	72	66	7	2	47	61	0	687	7,043	8,276
5	161	18	721	168	79	59	272	7,454	0	2,468	29,587	40,989
5A[d]	277	9	56	63	4	2	47	52	0	646	6,467	7,623
6A	224	21	892	290	128	72	375	13,899	0	2,907	58,369	77,178
6B	221	27	896	293	137	72	375	13,838	0	3,087	72,778	91,725
6C	186	9	932	311	131	94	437	13,959	4	3,007	67,895	86,966
7	200	22	957	334	128	73	375	13,899	0	2,975	61,341	80,305
8	193	20	879	290	128	72	375	13,899	0	2,890	58,060	76,807
9[e]	546	193	1,116	269	151	72	372	13,846	0	2,756	55,091	74,413

[a] Direct effects include both permanent and temporary effects.

[b] Tidal Brackish Emergent Wetland (all approximately 1 acre) and Inland Dune Scrub (no effect) are not shown.

[c] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

[d] Alternatives 2D, 4,4A, and 5A also include 2,019 acres of dredging of open water in Clifton Court Forebay (1,931 acres) and other temporary disturbances (368 acres) to tidal perennial aquatic not shown in the table.

[e] Alternative 9 also includes dredging of 517 acres of open water in Middle River and Victoria and North Canals not shown in the table.

Increases Associated with Protection and Restoration

The principal intent of the BDCP and California WaterFix is to improve habitat conditions for covered special-status species in the Plan Area through habitat protection, restoration, and enhancement. These improvements would occur incrementally over the life of the project's restoration activities. Tables 12-ES-2 and ES-2A summarize the natural communities protection and restoration acreage goals under conservation measures for the BDCP alternatives and Environmental Commitments for the non-HCP alternatives. Each of the alternatives analyzed in this chapter, except Alternatives 5 and 7 and the No Action Alternative, would include these goals. For the BDCP alternatives, the 69,275 acres of natural communities and cultivated land protection and the 83,839 acres of natural communities restoration (Table 12-ES-2), combined with the Plan's goals of enhancement of all new conservation lands, would provide a substantial offset for the temporary and permanent losses associated with facilities construction and habitat conversion of these alternatives, which would range from 74,413 to 92,301 acres. The tidal, nontidal, riparian, and seasonal wetland expansions would provide long-term benefits for most special-status and common species in the Plan Area. The exception would be habitat for species that rely heavily on modified landscapes, including cultivated lands and managed wetland. The acreages of habitat provided by these land cover types would be reduced; however, the value they provide would be enhanced by the management activities that would accompany habitat protection and restoration actions directed by the Plan.

Because it would restore 40,000 fewer acres of tidal marsh, Alternative 5 would have a much smaller cultivated lands and managed wetland conversion effect compared with the other alternatives. However, Alternative 5 would also provide 40,000 fewer acres of tidal wetland and transitional uplands than the other alternatives would offer. Nonetheless, Alternative 5 would provide for expansions of all the key natural communities targeted by the Plan when compared with Existing Conditions and the No Action Alternative. Alternative 7 would result in a more substantial reduction of cultivated lands and managed wetland in the Plan Area, but a net expansion of the key natural communities addressed in the Plan. Also, Alternative 7 would provide an additional 10,000 acres of riparian and floodplain habitat associated with seasonally inundated floodplain restoration when compared with the other alternatives.

With the exception of Alternatives 5 and 7, CM3 and CM4 would provide 153,114 acres of natural communities protection and restoration. The non-HCP alternatives, with Environmental Commitment 3, would provide approximately 12,000 to 15,000 acres of natural communities protection and restoration. Environmental Commitments 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16 would provide at least another 1,000 to 2,000 acres of protection and restoration.

The No Action Alternative does not include a comprehensive plan for expansion of natural communities that provide habitat for special-status and common species found in the Plan Area. There would be no large-scale conversions of cultivated lands and managed wetland; there would be numerous disassociated projects and programs that would result in relatively small losses of these managed lands in favor of wetland and riparian habitats.

The proposed restoration and protection for Alternatives 2D, 4A, and 5A are presented in Table 12-ES-2A.

Table 12-ES-2. Natural Communities Protection and Restoration Included in the BDCP

BDCP Conservation Measures	Acres
Protection	
CM3: Natural Communities Protection and Restoration	
Valley/foothill riparian	750
Vernal pool complex	600
Alkali seasonal wetland complex	150
Grassland	8,000
Managed wetland	1,500
Managed wetland (natural community)	6,600
Cultivated lands (non-rice)	48,125
Cultivated lands (rice)	500
Cultivated lands (rice or equivalent)	3,000
Nontidal marsh	50
Total Protection	**69,275**
Restoration	
CM4: Tidal Natural Communities Restoration[a]	
Tidal brackish emergent wetland	6,000
Tidal freshwater emergent wetland	24,000
Tidal perennial aquatic (below mean lower low water)	N/A
Tidal wetland of any type and transitional uplands	35,000
Subtotal: Tidal wetland restoration	65,000
CM5: Seasonally Inundated Floodplain Restoration[b]	10,000
CM6: Channel Margin Enhancement[c]	20 miles
CM7: Riparian Natural Community Restoration	5,000
CM8: Grassland Natural Community Restoration	2,000
CM9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	
Vernal pool complex	67
Alkali seasonal wetland complex	72
CM10: Nontidal Marsh Restoration	
Nontidal marsh	1,200
Managed wetland	500
Total Restoration	**83,839**
Total Protection and Restoration	**153,114**

[a] Under Alternative 5, 25,000 acres of tidal habitat would be restored under CM4.
[b] Under Alternative 7, 20,000 acres of seasonally inundated floodplain would be restored under CM5.
[c] Under Alternative 7, 40 linear miles of channel margin habitat would be enhanced under CM6.

Table 12-ES-2A Environmental Commitments under Alternatives 2D, 4A, and 5A

Environmental Commitment 3: Natural Communities Protection and Restoration	Alternative 2D	Alternative 4A	Alternative 5A
Valley/Foothill Riparian	Up to 120 acres	Up to 103 acres	Up to 87 acres
Grassland	Up to 1,078 acres	Up to 1,060 acres	Up to 1,033 acres
Vernal Pool Complex and Alkali Seasonal Wetland Complex	Up to 188 acres	Up to 188 acres	Up to 188 acres
Nontidal Marsh	Up to 194 acres	Up to 119 acres	Up to 119 acres
Cultivated Lands	Up to 13,432 acres	Up to 11,870 acres	Up to 11,301 acres
Total	**Up to 15,012 acres**	**Up to 13,340 acres**	**Up to 12,728 acres**
Environmental Commitment 4: Tidal Natural Communities Restoration	Up to 300 acres	Up to 295 acres	Up to 292 acres
Environmental Commitment 6: Channel Margin Enhancement	Up to 5.5 levee miles	Up to 4.6 levee miles	Up to 3.1 levee miles
Environmental Commitment 7: Riparian Natural Community Restoration	Up to 293 acres	Up to 251 acres	Up to 213 acres
Environmental Commitment 8: Grassland Natural Community	Up to 1,088 acres	Up to 1,070 acres	Up to 1,043 acres
Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	Up to 48 acres	Up to 48 acres	Up to 48 acres
Environmental Commitment 10: Nontidal Marsh Restoration	Up to 1,356 acres	Up to 832 acres	Up to 832 acres
Environmental Commitment 11: Natural Communities Enhancement and Management	At sites protected or restored under Environmental Commitments 3–10		
Environmental Commitment 12: Methylmercury Management	At sites restored under Environmental Commitment 4		
Environmental Commitment 15: Localized Reduction of Predatory Fishes	At north Delta intakes and at Clifton Court Forebay		
Environmental Commitment 16: Nonphysical Fish Barrier	At Georgiana Slough		

Effects on Wetlands and Other Waters of the United States

The estimated area of fill (permanent and temporary) of wetlands and other waters of the United States potentially under jurisdiction of the U.S. Army Corps of Engineers (jurisdictional waters) from constructing the water conveyance facilities would be largest under Alternative 9 (Table 12-ES-3). Fill of jurisdictional waters would be relatively similar under the east (1B, 2B, and 6B), and west (1C, 2C, and 6C) alignments, less under the modified pipeline/tunnel alignments (2D, 4, 4A, and5A), and substantially less under the pipeline/tunnel alternatives (1A, 2A, 3, 5, 6A, 7, and 8). Of these alternatives, the fill would be largest under Alternative 2B. Under Alternatives 2D, 4, 4A, and 5A larger areas of nonwetland waters of the United States would be temporarily disturbed due to work in Clifton Court Forebay; however, the forebay would ultimately expand by 450 acres and thus largely offset any losses there. Implementing Alternative 5 would result in the least fill of nonwetland waters of the United States.

Under the No Action Alternative, there would be no water conveyance facilities construction effects on jurisdictional wetlands and other waters of the United States. Also, there would be no restoration, protection, and enhancement of jurisdictional wetlands resulting from the BDCP's other conservation measures. Jurisdictional wetlands could increase in area and habitat value under several programs that are under way or in the planning stages to increase wetlands and riparian natural communities in the absence of a BDCP. The potential exists for levee deterioration and repairs, global climate change and associated sea level rise, and seismic activity that damages levees to result in substantial loss of jurisdictional wetlands.

Table 12-ES-3. Fill of Wetlands and Other Waters of the United States from Construction of Water Conveyance Facilities (CM1) (acres)

Alternative[a]	Wetlands	Other Waters of the United States	Total Waters of the United States
1A	142	284	426
1B	317	486	803
1C	180	619	799
2A	144	304	448
2B	330	525	855
2C	180	619	799
2D[b]	249	485	734
3	134	242	376
4[b]	259	440	698
4A[b]	259	440	698
5	134	221	355
5A[b]	232	441	673
6A	142	284	426
6B	317	486	803
6C	180	619	799
7	140	251	391
8	140	251	291
9[c]	231	776	1,007

[a] Dark shading= pipeline/tunnel, light shading = east alignment, no shading =west alignment and separate corridors (Alternative 9).

[b] Additional temporary impact of 1931 acres to Clifton Court Forebay due to dredging.

[c] Additional temporary impact of 669 acres to tidal channel, forest, scrub-shrub, and emergent wetland due to dredging effects.

Effects on Invertebrates

The acreages of effects on special-status invertebrate species' habitats that would result from action alternatives are summarized below in Table 12-ES-4. Restoration, protection, and management actions would account for the majority of the effects on invertebrates.

Most of the effects on vernal pool species and valley elderberry longhorn beetle for the BDCP alternatives would result from tidal natural communities restoration. Alternative 5, which would have 40,000 fewer acres of tidal habitat restoration, would have substantially less effect on vernal pool species and valley elderberry longhorn beetle relative to the other alternatives. The other 14 BDCP alternatives differ in their effects on these species based on the alternatives' respective conveyance alignments (vernal pool species and valley elderberry longhorn beetle), the number and location of intakes along the Sacramento River (valley elderberry longhorn beetle), and the amount of floodplain restoration (valley elderberry longhorn beetle under Alternative 7). As seen in Table 12-ES-4, the west alignment (Alternatives 1C, 2C, and 6C) would result in the greatest effect on vernal pool crustaceans. This greater effect would be due to construction of a canal west of Clifton Court Forebay that would pass through an area of vernal pool complex and alkali seasonal wetland that could provide vernal crustacean habitat. Alternative 9 effects on valley elderberry longhorn beetle would be the greatest due to effects on riparian habitat along Middle River. The 10,000-acre increase in seasonal floodplain restoration under Alternative 7 would result in effects on 100 additional acres of suitable valley elderberry longhorn beetle habitat. Alternative 7 would be the same as Alternative 8 except for Alternative 7's greater floodplain restoration and channel margin enhancement. However, the seasonal floodplain restoration under Alternative 7 would by the late long-term result in an overall benefit to valley elderberry longhorn beetle by creating approximately 3,000 additional acres of riparian habitat. The remaining BDCP alternatives differ in their effects on valley elderberry longhorn beetle due to the number and location of intakes along the Sacramento River.

All of the BDCP alternatives except Alternatives 5 and 7 would have the same potential effects on Sacramento and Antioch Dunes anthicid beetles as result of tidal habitat restoration, seasonal floodplain restoration, and channel margin enhancement. Alternative 5 would have less potential effect on the anthicid beetles due to decreased tidal habitat restoration (40,000 acres less) and Alternative 7 would have greater potential effect due to a greater amount of seasonal floodplain restoration (10,000 more acres) and channel margin enhancement (20 more miles). However Alternative 7's additional restoration in the long run would likely increase the amount of habitat available to anthicid beetles beyond that produced under the other alternatives.

Alternative 5 would also have fewer potential effects on delta green ground beetle if tidal habitat restoration is excluded from the Cache Slough area. All of the other alternatives would have the same potential effect on delta green ground beetle.

The non-HCP alternatives (2D, 4A, and 5A) would have substantially fewer impacts on vernal pool crustaceans and valley elderberry longhorn beetle compared with the BDCP alternatives due to having much fewer impacts from restoration. Of these alternatives, Alternative 5A would have fewer impacts on valley elderberry longhorn beetle habitat because of having fewer intakes along the Sacramento River. The impacts on other invertebrate species would be the same for these three alternatives.

Potential effects on callippe silverspot butterfly would be the same for all alternatives because potential grassland protection and management, which could result in effects on the species, would not differ.

Under the No Action Alternative, the effects on invertebrate species resulting from water conveyance facilities construction would not occur and neither would the benefits and contributions to recovery resulting from the other BDCP conservation measures. As seen in Table 12-7 in Section 12.3.3.1, *No Action Alternative*, there are several existing or proposed conservation projects under the No Action Alternative that could benefit some of the invertebrate species, including riparian habitat and floodplain restoration projects. However, many of these projects and plans do not provide the same magnitude of conservation and contribution to recovery of invertebrate species within the Delta that the BDCP offers and were not developed in consideration of the needs and interests of all of the covered invertebrate species addressed by the BDCP. Vernal pool crustacean habitat could be negatively affected by some of the proposed tidal habitat restoration projects listed in Table 12-7. Also, these No Action Alternative projects would not provide the same contributions to invertebrate species recovery that the BDCP offers because the BDCP would provide habitat protection and restoration beyond what is typically required for mitigation of individual projects.

Table 12-ES-4. Direct Effects of Alternatives on Invertebrate Habitat in the Terrestrial Biological Resources Study Area (acres)[a]

Alternative[b]	Vernal Pool Crustaceans[c]	Valley Elderberry Longhorn Beetle	Nonlisted Vernal Pool Invertebrates[d]	Sacramento and Antioch Dunes Anthicid Beetles	Delta Green Ground Beetle[e]	Callippe Silverspot Butterfly[e]
1A	375	1,560	375	NA	0	0
1B	376	1,544	376	NA	0	0
1C	453	1,550	453	NA	0	0
2A	375	1,572	375	NA	0	0
2B	376	1,572	376	NA	0	0
2C	453	1,551	453	NA	0	0
2D	48	365	48	NA	0	0
3	375	1,526	375	NA	0	0
4	395	1,557	395	NA	0	0
4A	48	372	48	NA	0	0
5	272	1,269	272	NA	0	0
5A	48	318	48	NA	0	0
6A	375	1,560	375	NA	0	0
6B	376	1,544	376	NA	0	0
6C	453	1,550	453	NA	0	0
7	375	1,634	375	NA	0	0
8	375	1,533	375	NA	0	0
9	372	1,872	372	NA	0	0

[a] Direct effects include both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

[c] Vernal pool crustaceans are California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp.

[d] Nonlisted vernal pool invertebrates are Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle.

[e] Alternatives could affect species but would not result in a loss of potential habitat. This potential affect would be the same for all alternatives.

NA = Not Available (alternatives have a potential for a loss of habitat that can't be quantified).

Effects on Amphibians and Reptiles

The effects on habitat for special-status amphibian and reptile species' resulting from the alternatives are summarized below in Table 12-ES-5. All of these species would be affected by the different conveyance facilities and some species would be largely affected by tidal habitat restoration (California tiger salamander, giant garter snake, and western pond turtle). Other conservation measures that would affect amphibians and reptiles are Yolo Bypass fisheries enhancement, seasonal floodplain restoration, and recreational improvements. Some of these species, such as California red-legged frog, San Joaquin coachwhip, and Blainville's horned lizard, have restricted ranges and, therefore, would be affected by only a few of the conservation measures.

California red-legged frog would be affected only by water conveyance facilities of the alternatives and by proposed recreational improvements because most other conservation activities would not extend into its range in the study area. The west alignment alternatives (1C, 2C, and 6C) and Alternatives 4 and 9 would have substantially less effect on California red-legged frog relative to the other alternatives because Alternatives 1C, 2C, 4, 6C, 9 would have smaller borrow and spoils areas to the southwest of Clifton Court Forebay, where habitat for a number of amphibian and reptile species exists. Alternatives 2D, 4A, and 5A would also only affect California red-legged frog with the construction of the water conveyance facility and would have the same impact because they share the same construction footprint around Clifton Court Forebay.

California tiger salamander would mostly be affected by tidal habitat restoration and, to a lesser extent, by the conveyance facilities construction, Yolo Bypass fisheries improvement, recreational facility improvements, and conservation hatchery construction. The action alternatives differ from one another in their potential to affect California tiger salamander mostly based on the location and size of borrow and spoils areas to the southwest of Clifton Court Forebay. Most of the pipeline/ tunnel alternatives (1A, 2A, 3, 6A, 7, and 8) and the eastern alignment alternatives (1B, 2B, and 6B) would result in the greatest effect on California tiger salamander because of their construction activity southwest of Clifton Court Forebay. The reduced amount of tidal habitat restoration under Alternative 5 would result in substantially less effect when compared with all of the other alternatives. Alternatives 2D, 4A, and 5A would affect California tiger salamander with the construction of the water conveyance facility and potentially tidal restoration and would have the same impact because they share the same construction footprint around Clifton Court Forebay and are estimated to affect the same amount of habitat with tidal restoration.

Giant garter snake would be affected mostly by tidal natural communities restoration and conveyance facilities construction, and to a lesser extent by Yolo Bypass fisheries improvements and seasonal floodplain restoration. Effects of the alternatives would differ from one another mostly based on their respective alignments and Alternative 5's reduced amount of tidal habitat restoration. Other smaller differences would result from the number and location of intakes along the Sacramento River. Alternative 9 would result in the greatest effect on giant garter snake due to the larger amounts of in-channel work that would be required; however, most of the Alternative 9 effects would be temporary. The east conveyance alignment (Alternatives 1B, 2B, and 6B) would also result in large effects on giant garter snake and would create barriers to movement across the species' range in the study area. Alternative 5, which would restore 40,000 fewer acres tidal habitat, would result in substantially less effect than the other alternatives (roughly 900–1,000 fewer acres impacted). However, giant garter snake would also have substantially less tidal freshwater emergent wetland habitat restored under Alternative 5 relative to the other alternatives. Alternatives 2D, 4A, and 5A would affect giant garter snake primarily from water conveyance facility construction and thus differ mostly due to the different number and location of intakes. Alternative 4A, also includes geotechnical exploration impacts, which accounts for 55 acres of impacts and explains why its impacts on gianter garter snake are greater than under 2D, which has more intakes.

For most of the action alternatives, western pond turtle would be affected primarily by tidal habitat restoration, and secondarily by conveyance facilities construction and Yolo Bypass fisheries improvements. Alternatives 4 and 9 would have substantial effects resulting from conveyance facilities construction associated with the dredging of aquatic habitat (Clifton Court Forebay for Alternative 4 and Middle River for Alternative 9). Alternative 4 would have the greatest effect on western pond turtle relative to the other alternatives; however, nearly all of this difference is associated with the temporary effect of dredging Clifton Court Forebay, which is identified as aquatic habitat for the species. Alternative 5 would have the least effect on western pond turtle because of the alternative's 40,000 fewer acres of tidal habitat restoration. Alternatives 2D, 4A, and 5A would also have relatively large effects on western pond turtle that are largely due to the temporary dredging of Clifton Court Forebay (1,931 acres). The differences between these alternatives are due to the number of intakes along the Sacramento River and the geotechnical exploration impacts under Alternative 4A, which account for 50 acres of impact.

Among the other special-status reptiles, only San Joaquin coachwhip and Blainville's horned lizard would experience quantifiable effects. Only conveyance facilities construction would affect coachwhip and horned lizard. Alternatives 4, 2D, 4A, and 5A would have the largest effect of all of the alternatives due to the activities around Clifton Court Forebay. Alternative 9 would have substantially less effect than all of the other alternatives because it would generally avoid modifying grassland habitat in the vicinity of Clifton Court Forebay. Alternatives 2D, 4A, and 5A would have the same effects on other special-status reptiles because they share the same footprint around Clifton Court Forebay.

Under the No Action Alternative, there would be no water conveyance facilities construction effects on amphibian and reptile species. Also, there would be no benefits and contributions to recovery from the BDCP's other conservation measures. As seen in Table 12-7 in Section 12.3.3.1, *No Action Alternative*, there are several existing or proposed conservation activities under the No Action Alternative that could benefit amphibian and reptile species, including grassland and vernal pool protection and management as part of several approved or pending habitat conservation plans and natural community conservation plans that overlap with the Plan Area. However, many of these projects and plans do not provide the same magnitude of reptile and amphibian habitat conservation and contribution to recovery within the Delta that the BDCP offers and were not developed in consideration of the needs and interests of all of the covered reptile and amphibian species that the BDCP addresses.

1 **Table 12-ES-5. Direct Effects of Alternatives on Amphibian and Reptile Habitat in the Terrestrial Biological Resources Study Area (acres)[a]**

Alternative[b]	California Red-Legged Frog	California Tiger Salamander	Giant Garter Snake	Western Pond Turtle	Special-Status Reptiles[c]
1A	183	797	3,902	1,669	338
1B	184	801	4,180	1,749	335
1C	97	716	4,020	1,703	350
2A	183	795	3,918	1,667	338
2B	184	801	4,233	1,779	335
2C	97	716	4,021	1,703	350
2D	65	109	975	2,697	371
3	183	797	3,843	1,657	338
4	77	685	4,174	4,007	371
4A	65	109	983	2,747	371
5	183	554	3,011	1,315	338
5A	65	109	893	2,696	371
6A	183	797	3,902	1,669	338
6B	184	801	4,180	1,749	335
6C	97	716	4,020	1,703	350
7	183	797	3,997	1,751	338
8	183	797	3,850	1,666	338
9	24	634	4,497	2,708	30

[a] Direct effects include both permanent and temporary.
[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).
[c] Special-status reptiles are silvery legless lizard, San Joaquin coachwhip, and Blainville's horned lizard.

Effects on Birds

The conversion of special-status bird species habitat that would result from the action alternatives is summarized below in Table 12-ES-6. Each of the conservation measures, or Environmental Commitments under the non-HCP alternative, that would actively convert habitat under all of the alternatives would affect at least one of the bird species addressed in this EIR/EIS. The conveyance facilities for the alternatives generally account for a small fraction of the effects relative to the other conservation measures. However, the conveyance facilities under the east alignment (Alternatives 1B, 2B, and 6B) and Alternative 9 would contribute substantially to effects on birds. For most alternatives, tidal habitat restoration generally would account for the majority of the effects on birds. The decrease in tidal natural communities restoration associated with Alternatives 5 (40,000 fewer acres) and the non-HCP alternatives would decrease the effects on most bird species habitat, in some cases by more than half; however, species that utilize tidal habitats would also not receive the long-term benefits of the restored tidal habitat that would occur under the other alternatives. The larger acreage of seasonal floodplain restoration under Alternative 7 would not result in a substantial increase in effects on birds relative to the other alternatives, but Alternative 7's additional riparian and freshwater emergent wetland habitat restoration would provide greater benefits relative to the other alternatives.

California clapper rail and black tern would be affected similarly by all of the alternatives, except for the non-HCP alternatives, which would affect none. None of the alternatives would affect bank swallow habitat.

Black rail, least Bell's vireo, yellow warbler, Suisun song sparrow, saltmarsh common yellowthroat, western yellow-billed cuckoo, yellow-breasted chat, Cooper's hawk, osprey, cormorants, herons, egrets, least bittern, white-faced ibis, and Modesto song sparrow would be affected generally the same (impacted habitat acreages would differ by 1% to 3%) under all of the BDCP alternatives except Alternatives 5 and 9. With its 40,000 fewer acres of tidal habitat restoration, Alternative 5 would effect substantially fewer acres of habitat (20 to 50% less) for these species relative to the other alternatives. However, black rail, Suisun song sparrow, and saltmarsh common yellowthroat would also not receive the long-term benefit of the additional tidal habitat restoration offered by the other alternatives. Alternative 9 would result in greater effect on most of these species because Alternative 9 would have greater effects on valley/foothill riparian, tidal freshwater emergent wetland, and nontidal freshwater perennial emergent wetland natural communities; however, most of the riparian habitat affected by Alternative 9 is considered low-value habitat for these species. Alternatives 2D, 4A, and 5A would affect substantially less of these habitats, and would result in no effect on Suisun song sparrow, and saltmarsh common yellowthroat habitats.

Greater and lesser sandhill cranes, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, golden eagle, ferruginous hawk, short-eared owl, northern harrier, mountain plover, California horned lark, grasshopper sparrow, loggerhead shrike, and yellow-headed blackbird all have their impact acreages trend in the same manner across the alternatives. The east alignment, in particular Alternative 2B (larger effects associated with intake pipeline construction), would result in the largest effect on these species because of the east alignment's greater effects on cultivated lands and grasslands. Alternative 5, with its decreased tidal habitat restoration, would result in the least effects on these species of all of the alternatives but it would also provide fewer benefits to those species that use tidal habitat. The non-HCP alternatives would affect less habitat for greater and lesser sandhill cranes, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, golden eagle, ferruginous hawk, short-eared owl, northern harrier, mountain plover, California horned lark, grasshopper sparrow, loggerhead shrike, and yellow-headed blackbird.

California least tern would be affected by all of the alternatives similarly except for Alternatives 4, 5, 9, 2D, 4A, and 5A. Alternatives 4 and 9 would result in substantially larger effects because of dredging activities in tidal perennial aquatic habitat; however these effects would be temporary. Alternative 5 would result in less effect on this habitat because of the alternative's reduced tidal habitat restoration. For Alternatives 2D, 4A, and 5A, the effects on special-status birds would be substantially less than under the BDCP alternatives because of the much smaller amounts of restoration. The impacts from Alternative 2D would generally be greater on special-status birds because of the larger impacts on cultivated lands that are used by these species for foraging. Alternative 4A would have greater impacts on a few species that predominantly use wetland habitats because of the inclusion of geotechnical exploration as part of Alternative 4A.

Under the No Action Alternative, there would be no water conveyance facilities construction effects on bird species. Also, there would be no benefits and contributions to recovery from the BDCP's other conservation measures. As seen in Table 12-7 in Section 12.3.3.1, *No Action Alternative*, there are several existing or proposed conservation projects under the No Action Alternative that could benefit bird species, including tidal habitat restoration, freshwater emergent wetland restoration, grassland protection, and riparian habitat restoration, as well as the management of agricultural lands and managed wetlands for the benefits of wildlife. However, many of these projects and plans do not provide the same magnitude of conservation and contribution to recovery of bird habitat within the Delta that the BDCP offers and were not developed in consideration of the needs and interests of all of the covered bird species addressed by the BDCP. Furthermore, under the No Action Alternative, both gradual and catastrophic natural phenomena, such as continued Delta island land subsidence, levee degradation and failure from floods or seismic events, and climate change, could affect the grasslands, cultivated lands, and valley/foothill riparian habitat used by birds in the study area (see Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*). These changes could, in the long term, benefit species that use open waters and tidal wetlands, but habitat in the Delta would decline for those species that use cultivated lands, grasslands, and riparian vegetation.

Table 12-ES-6. Direct Effects of Alternatives on Bird Habitat in the Terrestrial Biological Resources Study Area (acres)[a]

Alternative[b]	California Black Rail	California Clapper Rail	California Least Tern	Greater Sandhill Crane	Lesser Sandhill Crane	Least Bell's Vireo & Yellow Warbler	Suisun Song Sparrow & Saltmarsh Common Yellowthroat	Swainson's Hawk	Tricolored Blackbird	Western Burrowing Owl	Western Yellow-Billed Cuckoo	White-Tailed Kite	Yellow-Breasted Chat
1A	3,132	77	243	7,372	15,881	812	3,688	55,306	43,612	45,576	666	59,567	811
1B	3,131	77	240	13,186	23,861	819	3,688	65,739	51,616	51,889	673	69,935	817
1C	3,133	77	204	8,113	21,495	823	3,688	62,459	48,341	50,433	677	66,281	822
2A	3,131	77	250	7,596	16,106	811	3,688	55,551	43,865	45,818	664	59,801	811
2B	3,131	77	266	13,473	24,151	829	3,688	66,035	51,904	52,156	682	70,240	830
2C	3,132	77	204	8,113	21,495	823	3,688	62,460	48,341	50,433	677	66,283	823
2D	8	0	2,295	5,229	5,329	57	0	7,404	6,693	7,134	43	7,430	56
3	3,131	77	202	7,036	15,546	803	3,688	54,989	43,337	45,297	658	59,245	803
4	3,140	77	2,3621	6,966	14,875	794	3,688	54,864	43,341	45,405	667	59,126	813
4A	13	0	2,299	4,576	4,676	60	0	6,748	6,177	6,453	47	6,777	59
5	1,542	77	178	6,886	8,444	661	1,637	29,519	25,293	26,445	545	31,203	661
5A	8	0	2,254	4,152	4,252	49	0	6,314	5,819	6,084	37	6,336	49
6A	3,132	77	243	7,372	15,881	812	3,688	55,306	43,612	45,576	666	59,567	811
6B	3,131	77	240	13,186	23,861	819	3,688	65,739	51,616	51,889	673	69,935	817
6C	3,133	77	204	8,113	21,495	823	3,688	62,459	48,341	50,433	677	66,281	822
7	3,131	77	217	7,110	15,623	858	3,688	57,965	45,303	47,870	699	62,052	858
8	3,131	77	211	7,110	15,620	809	3,688	55,040	43,414	45,366	662	59,301	809
9	3,439	77	1,082	5,022	13,845	1,047	3,688	53,516	42,161	44,287	890	57,835	1,047

[a] Direct effects include both permanent and temporary effects.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

Alternative[b]	Cooper's Hawk & Osprey	Golden Eagle & Ferruginous Hawk	Cormorants, Herons & Egrets	Short-Eared Owl & Northern Harrier	Redhead & Tule Greater White-Fronted Goose	Mountain Plover	Black Tern	California Horned Lark & Grasshopper Sparrow	Least Bittern & White-Faced Ibis	Loggerhead Shrike	Modesto Song Sparrow	Bank Swallow	Yellow-Headed Blackbird
1A	677	29,424	893	50,507	NA	29,424	491	29,424	13,185	49,812	3,607	0	44,007
1B	707	34,581	897	57,123	NA	34,581	491	34,581	13,119	59,116	3,568	0	49,126
1C	732	33,637	933	55,870	NA	33,637	491	33,637	13,108	56,881	3,704	0	48,071
2A	681	29,365	893	50,493	NA	29,365	491	29,365	13,185	49,996	3,608	0	43,945
2B	714	34,602	910	57,223	NA	34,602	491	34,602	13,126	60,863	3,588	0	49,153
2C	733	33,638	932	55,870	NA	33,638	491	33,638	13,108	56,882	3,704	0	48,071
2D	53	5,311	78	5,626	NA	5,311	0	5,311	6	6,970	217	0	6,057
3	665	29,183	873	50,263	NA	29,183	491	29,183	13,183	49,529	3,586	0	43,757
4	669	29,606	868	50,879	NA	29,606	491	29,606	13,112	49,515	3,486	0	44,892
4A	50	4,942	72	5,187	NA	4,942	0	4,942	9	6,464	150	0	5,626
5	577	16,129	721	27,117	NA	16,129	152	16,129	6,805	25,773	2,998	0	24,121
5A	39	4,531	56	4,786	NA	4,531	0	4,531	6	5,961	121	0	5,190
6A	677	29,424	893	50,507	NA	29,424	491	29,424	13,185	49,812	3,607	0	44,007
6B	707	34,581	897	57,123	NA	34,581	491	34,581	13,119	59,116	3,568	0	49,126
6C	732	33,637	933	55,870	NA	33,637	491	33,637	13,108	56,881	3,704	0	48,071
7	743	30,720	957	52,434	NA	30,720	491	30,720	13,185	52,462	3,673	0	45,323
8	668	29,270	879	50,348	NA	29,270	491	29,270	13,185	49,581	3,594	0	43,843
9	760	28,690	1,116	49,811	NA	28,690	491	28,690	13,109	48,125	3,974	0	43,382

[a] Direct effects include both permanent and temporary effects.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

NA = Not applicable, no quantitative analysis conducted.

Effects on Mammals

The effects of the BDCP alternatives on habitat for special-status mammal species are summarized below in Table 12-ES-7. There is no general trend in mammal effects across the alternatives. Because the majority of the mammal groups addressed in this EIR/EIS have restricted ranges within the study area, the various conservation measures would affect mammals differently based on their specific location. Riparian brush rabbit and riparian woodrat are restricted to the southernmost portion of the study area and, therefore, would be primarily affected by seasonal floodplain restoration in this area and by the water conveyance facilities. Salt marsh harvest mouse and Suisun shrew within the study area are restricted to Suisun Marsh and would only be affected by tidal habitat restoration. San Joaquin kit fox and American badger are only considered to occur in the grasslands in the southwest portion of the study area and would thus only be affected by the conveyance facilities construction. San Joaquin pocket mouse and bat species roosting habitat could occur throughout the study area and thus would be affected by various conservation measures.

As noted above, riparian brush rabbit and riparian woodrat would be affected primarily by floodplain restoration and the conveyance facilities, and to a lesser degree by tidal habitat restoration. The west conveyance alignment (Alternatives 1C, 2C, and 6C) would result in the least effect on riparian brush rabbit due to the location of the alignment in the southern portion of the study area. Riparian woodrat would be least affected by Alternative 5 due to the decrease in tidal habitat restoration. Alternative 7, with its increased floodplain restoration, would result in the greatest effects on both species; however, in the long term, riparian brush rabbit and riparian woodrat would benefit from the expansion of riparian habitat with well-developed understory that would occur as part of Alternative 7’s 10,000 acres of additional seasonal floodplain restoration. Alternatives 2D, 4A, and 5A would impact riparian brush rabbit and Sand Joaquin kit fox similar to the BDCP alternatives because these species would only be affected by water conveyance facility construction. The non-HCP alternatives would have no effect on riparian woodrat.

Salt marsh harvest mouse and Suisun shrew would be affected similarly by all BDCP alternatives except Alternative 5. Though this alternative would decrease the effects on these species, it also would limit the amount of habitat converted from managed wetland to tidal brackish emergent wetland, thereby decreasing the benefit to these species in the long term. The non-HCP alternatives would have no effect on these species.

San Joaquin kit fox and American badger would be affected only by the water conveyance facilities of the alternatives. The west alignment (Alternatives 1C, 2C, and 6C) would have the largest effect on these species. Alternative 9, the Through Delta/Separate Corridors alternative, would affect 90% less habitat acreage than the other alternatives. The non-HCP alternatives would have similar impacts on San Joaquin kit fox and American badger as the BDCP alternatives.

As mentioned above, San Joaquin pocket mouse and bat species would be affected by multiple conservation measures because of their broad habitat distribution. Therefore, a decrease in the areal extent of any one of these measures associated with a particular alternative would result in a decrease in effect on these species. The largest effect on the mouse and the bat species would result from Alternative 2B because of the areal extent of the east alignment and the number and location of intakes. Of the BDCP alternatives, the least effect on these species would result from Alternative 5 due to the decrease in the number of intakes and the reduction in tidal habitat restoration. However, the non-HCP alternatives, 2D, 4A, and 5A, would have the smallest effect of all the alternatives for these species.

1 **Table 12-ES-7. Direct Effects of Alternatives on Mammal Habitat in the Terrestrial Biological Resources Study Area (acres)[a]**

Alternative[b]	Riparian Brush Rabbit	Riparian Woodrat	Salt Marsh Harvest Mouse	Suisun Shrew	San Joaquin Kit Fox & American Bader	San Joaquin Pocket Mouse	Special-Status Bat Species (roosting only)[c]
1A	349	84	6,968	401	348	2,906	2,215
1B	338	85	6,968	401	345	3,087	2,578
1C	245	85	6,968	401	361	3,008	2,250
2A	349	84	6,968	401	348	2,923	2,302
2B	338	85	6,968	401	345	3,117	2,672
2C	245	85	6,968	401	361	3,008	2,249
2D	233	0	0	0	330	673	293
3	347	84	6,968	401	348	2,869	2,089
4	374	84	6,968	401	334	2,955	2,046
4A	250	0	0	0	330	686	269
5	311	75	3,746	164	348	2,468	1,130
5A	233	0	0	0	330	646	248
6A	349	84	6,968	401	348	2,907	2,214
6B	338	85	6,968	401	345	3,087	2,578
6C	245	85	6,968	401	361	3,007	2,249
7	470	158	6,968	401	348	2,975	2,277
8	349	84	6,968	401	348	2,890	2,175
9	372	87	6,968	401	33	2,756	2,140

[a] Direct effects include both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

[c] Special-status bat species are big brown bat, California myotis, hoary bat, little brown myotis, Mexican free-tailed bat, silver-haired bat, western red bat, western small-footed myotis, Yuma myotis, canyon bat, pallid bat, Townsend's big-eared bat, western mastiff bat; only effects on roosting habitat shown here.

Under the No Action Alternative, there would be no water conveyance facilities construction effects on mammal species. Also, there would be no benefits and contributions to recovery from the other BDCP conservation measures. As seen in Table 12-7 in Section 12.3.3.1, *No Action Alternative*, there are several existing or proposed conservation projects under the No Action Alternative that could benefit mammal species, including tidal habitat restoration, grassland protection, and riparian habitat restoration. However, many of these projects and plans do not provide the same magnitude of conservation and contribution to recovery of mammal habitat within the Delta that the BDCP offers and were not developed in consideration of the needs and interests of all of the covered mammal species addressed by the BDCP.

Effects on Plants

Because the distribution of covered plant species in the study area is only partially documented, a habitat model was created for each species to ensure that effects on the species were not underestimated. The modeled habitat is essentially a distribution map for each species based on the characteristics, such as vegetation types, soil types, land forms, and elevation ranges, of habitat in which the species are known to occur. In the effects analysis, these habitat models served as surrogates for the amount and location of habitat for each covered plant species. The determination of effects of the alternatives on special-status plant species rely on the habitat models. The effects are summarized below by the natural communities in which the species occur. Tables 12-ES-8 through 12-ES-14 summarize these effects.

Vernal Pool Plants

Seventeen covered and noncovered special-status vernal pool plant species are present in the study area. Under the pipeline/tunnel alternatives (1A, 2A, 3, 5, 6A, 7, and 8) and the east alignment alternatives (1B, 2B, and 6B), no known occurrences of these species would be affected, and modeled vernal pool habitat would be affected primarily by tidal natural communities restoration activities. Under the BDCP modified pipeline/tunnel alternative (Alternative 4), one occurrence of alkali milk-vetch and 16 additional acres of modeled vernal pool habitat would be affected by construction of the water conveyance facilities. The greatest effects on vernal pool plant species would occur under the west alignment alternatives (1C, 2C, and 6C); three occurrences of alkali milk-vetch and two occurrences of Ferris' goldfields and 77 additional acres of modeled vernal pool habitat would be affected by construction of the west alignment water conveyance features. The non-HCP alternatives would have fewer impacts on vernal pool plants compared to the BDCP alternatives due to having substantially fewer impacts from tidal restoration. Because they share the same footprint around Clifton Court Forebay, all three of these alternatives would affect vernal pool plants the same, with one occurrence of alkali milk-vetch and 49 acres of modeled vernal pool plant habitat. Alternative 9 would have the fewest effects on vernal pool plant species, affecting no known occurrences of these species, and affecting modeled vernal pool habitat only through tidal natural communities restoration activities.

Alkali Seasonal Wetland Plants

Eight covered and noncovered special-status alkali seasonal wetland plant species occur in the study area. The BDCP east alignment alternatives (1C, 2C, and 6C) would result greatest impacts on special-status alkali seasonal wetland plant modeled habitat and occurrences. Under the BDCP modified pipeline/tunnel alternative (Alternative 4), two occurrences of San Joaquin spearscale, 10 additional acres of modeled habitat for San Joaquin spearscale, and 75 additional acres of modeled habitat for Delta button-celery would be affected by construction of the water conveyance facilities relative to the other pipeline/tunnel alternatives (1A, 2A, 3, 5, 6A, 7 and 8). Alternative 9 would have the fewest effects on alkali seasonal wetland plant species of the BDCP alternatives because construction of the water conveyance facilities would affect no known occurrences and no modeled habitat of alkali seasonal wetland plants. However, the snon-BDCP alternatives (2D, 4A, and 5A) would have the least impacts on alkali seasonal wetland plants of all the action alternatives due to having substantially fewer impacts from tidal restoration. All three of these alternatives would roughly affect alkali seasonal wetland plants the same because they share the same footprint around Clifton Court Forebay; however, Alternative 2D would have one more acre of impact on heartscale modeled habitat due to having a larger amount of tidal restoration and Alternative 5A would have one fewer acre of San Joaquin spearscale modeled habitat relative to the other two non-BDCP alternatives due to having fewer acres of tidal restoration.

Grassland Plants

Thirteen covered and noncovered special-status grassland plant species occur in the study area. Under all BDCP alternatives, one occurrence of Carquinez goldenbush and four acres of modeled habitat for Carquinez goldenbush would be affected by tidal habitat restoration, and one occurrence of Parry's rough tarplant would be affected by Yolo Bypass fisheries enhancements. Under the pipeline/tunnel alternatives (1A, 2A, 3, 5, 6A, 7, and 8), the east alignment alternatives (1B, 2B, and 6B), Alternative 4, and Alternative 9, no additional covered and noncovered grassland plant species would be affected by construction of the water conveyance facilities. However, under the west alignment alternatives (1C, 2C, and 6C), one occurrence of Keck's checker-mallow and one occurrence of caper-fruited tropidocarpum could be affected by construction of the water conveyance facilities. All three non-HCP alternatives (2D, 4A, and 5A) would have fewer impacts on special-status grassland plants compared to the BDCP alternatives due to having substantially less impacts from tidal restoration. They would affect no occurrences of grassland plant species and would affect 1 acre of modeled habitat for Carquinez goldenbush. All three of these alternatives would affect special-status grassland plants the same because they share the same footprint around Clifton Court Forebay.

Valley/Foothill Riparian Plants

Four covered and noncovered special-status valley/foothill riparian plant species occur in the study area. All BDCP alternatives would effect these species as a result of floodplain levee construction and increased frequency and duration of flooding. All three non-HCP alternatives (2D, 4A, and 5A) would have fewer impacts on special-status valley/foothill riparian plant habitat, and no occurrences, compared to the BDCP alternatives due to having substantially less impacts from tidal restoration and no floodplain restoration. All three of these alternatives would affect special-status valley/foothill riparian plants the same because they all avoid modeled habitat and occurrences for these species.

Tidal Wetland Plants

Eight covered and noncovered special-status tidal wetland plant species are present in the study area. The effects of restoration actions would be similar under all BDCP alternatives. The modeled habitat for special-status tidal wetland plants affected by the BDCP alternatives is generally similar except for Alternative 9, which would impact substantially more habitat from in-channel dredging. The number of occurrences affected are generally similar. All three non-HCP alternatives (2D, 4A, and 5A) would have fewer impacts on special-status tidal wetland plants (fewer occurrences and fewer impacts on modeled habitat) compared to the BDCP alternatives due to having substantially less impacts from tidal restoration and no floodplain restoration. Alternative 5A would result in the fewest impacts on these species and Alternatives 4A and 2D would be roughly the same except for greater impacts on side-flowering skullcap from Alternative 4A.

Inland Dune Plants

Five noncovered special-status inland dune plant species are present in the study area. None of the action alternatives would affect the inland dune plants.

Nontidal Wetland Plants

Six noncovered special-status nontidal wetland plant species are present in the study area. The west alignment alternatives (1C, 2C, and 6C) would have the fewest effects on covered and noncovered tidal wetland plants as a result of constructing the water conveyance facilities. The east alignment alternatives (1B, 2B, and 6B) would affect the greatest number of occurrences. The modified pipeline/tunnel alternative (Alternative 4) would have a level of effects similar to that of the east alignment alternatives and Alternative 9. The pipeline/tunnel alternatives (1A, 2A, 3, 5, 6A, 7, and 8) would have slightly fewer effects on nontidal wetland plants than the east alignment alternatives, Alternative 4, and Alternative 9. All three non-HCP alternatives (2D, 4A, and 5A) would have roughly similar impacts on special-status non tidal wetland plants compared to the BDCP alternatives. Of thenon-HCP alternatives, Alternative 5A would result in the fewest impacts on these species, and Alternatives 4A and 2D would be roughly the same.

No Action Alternative

Under the No Action Alternative, there would be no water conveyance facilities construction effects on plant species. Also, there would be no benefits and contributions to recovery from the BDCP's other conservation measures. As seen in Table 12-7 in Section 12.3.3.1, *No Action Alternative*, there are several existing or proposed conservation projects under the No Action Alternative that could benefit some of the special-status plant species. However, many of these projects and plans are primarily focused on providing habitat for wildlife and do not provide the specific conservation and contribution to recovery of these plants species within the Delta that the BDCP offers, especially considering that conversion of habitat in the Delta as a result of climate change may reduce the distribution of plant species in the study area.

Table 12-ES-8. Direct Effects of Alternatives on Vernal Pool Plant Species in the Terrestrial Biological Resources Study Area (acres and occurrences)[a]

Alternative[b]	Modeled Vernal Pool Plant Habitat (acres)	Occurrences																
		Alkali milk-vetch	Dwarf downingia	Boggs Lake hedge-hyssop	Legenere	Heckard's pepper-grass	Ferris' milk-vetch	Vernal pool smallscale	Hogwallow starfish	Contra Costa goldfields	Ferris' goldfields	Cotula-leaf navarretia	Baker's navarretia	Colusa grass	Bearded popcorn-flower	Delta woolly-marbles	Saline clover	Solano grass
1A	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1B	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1C	452	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
2A	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2C	452	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
2D	49	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	391	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4A	49	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5A	49	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6A	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6B	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6C	452	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
7	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[a] Direct effects include both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

1 **Table 12-ES-9. Direct Effects of Alternatives on Alkali Seasonal Wetland Plant Species in the Terrestrial Biological Study Area (acres and occurrences)[a]**

	Modeled Habitat (acres)				Occurrences							
Alternative[b]	San Joaquin spearscale	Brittlescale	Heartscale	Delta button-celery[c]	San Joaquin spearscale	Brittlescale	Heartscale	Delta button-celery	Heckard's peppergrass	Crownscale	Palmate-bracted bird's-beak	Recurved larkspur
1A	748	4	306	21	1	0	0	0	1	1	0	0
1B	748	4	306	21	1	0	0	0	1	1	0	0
1C	823	5	307	130	3	0	1	0	1	1	0	1
2A	749	4	306	21	1	0	0	0	1	1	0	0
2B	749	4	306	21	1	0	0	0	1	1	0	0
2C	823	4	307	130	3	0	1	0	1	1	0	1
2D	96	1	15	97	1	0	0	0	0	1	0	0
3	748	4	306	21	1	0	0	0	1	1	0	0
4	758	4	306	96	2	0	0	0	1	1	0	0
4A	96	1	14	97	1	0	0	0	0	1	0	0
5	748	4	306	21	0	0	0	0	1	1	0	0
5A	95	1	14	97	1	0	0	0	0	1	0	0
6A	748	4	306	21	1	0	0	0	1	1	0	0
6B	748	4	306	21	1	0	0	0	1	1	0	0
6C	823	5	307	130	3	0	1	0	1	1	0	1
7	750	4	306	21	1	0	0	0	1	1	0	0
8	748	4	306	21	1	0	0	0	1	1	0	0
9	680	4	306	0	1	0	0	0	1	0	0	0

[a] Direct effects includes both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

[c] Delta button celery habitat includes both alkali seasonal wetlands and valley/foothill riparian. Habitat effects for the species can be found in both Tables 12-ES-8 and 12-ES-10.

Table 12-ES-10. Direct Effects of Alternatives on Grassland Plant Species in the Terrestrial Biological Study Area (acres and occurrences)[a]

	Modeled Habitat (acres)	Occurrences												
Alternative[b]	Carquinez goldenbush	Carquinez goldenbush	Big tarplant	Round-leaved filaree	Pappose tarplant	Parry's rough tarplant	Small-flowered morning-glory	Diamond-petaled poppy	Streamside daisy	Stinkbells	Fragrant fritillary	Gairdner's yampah	Keck's checker-mallow	Caper-fruited tropidocarpum
1A	4	1	0	0	0	1	0	0	0	0	0	0	0	0
1B	4	1	0	0	0	1	0	0	0	0	0	0	0	0
1C	4	1	0	0	0	1	0	0	0	0	0	0	1	1
2A	4	1	0	0	0	1	0	0	0	0	0	0	0	0
2B	4	1	0	0	0	1	0	0	0	0	0	0	0	0
2C	4	1	0	0	0	1	0	0	0	0	0	0	1	1
2D	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3	4	1	0	0	0	1	0	0	0	0	0	0	0	0
4	4	1	0	0	0	1	0	0	0	0	0	0	0	0
4A	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	4	0	0	0	0	1	0	0	0	0	0	0	0	0
5A	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6A	4	1	0	0	0	1	0	0	0	0	0	0	0	0
6B	4	1	0	0	0	1	0	0	0	0	0	0	0	0
6C	4	1	0	0	0	1	0	0	0	0	0	0	1	1
7	4	1	0	0	0	1	0	0	0	0	0	0	0	0
8	4	1	0	0	0	1	0	0	0	0	0	0	0	0
9	4	1	0	0	0	1	0	0	0	0	0	0	0	0

[a] Direct effects includes both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

Table 12-ES-11. Direct Effects of Alternatives on Valley/Foothill Riparian Plant Species in the Terrestrial Biological Study Area (acres and occurrences)[a]

	Modeled Habitat (acres)		Occurrences			
Alternative[b]	Delta button-celery[c]	Slough thistle	Delta button-celery	Slough thistle	Northern California black walnut	Wright's trichocoronis
1A	15	11	1	2	0	0
1B	15	11	1	2	0	0
1C	15	11	1	2	0	0
2A	15	11	1	2	0	0
2B	15	11	1	2	0	0
2C	15	11	1	2	0	0
2D	0	0	0	0	0	0
3	15	11	1	2	0	0
4	15	11	1	2	0	0
4A	0	0	0	0	0	0
5	15	11	1	2	0	0
5A	0	0	0	0	0	0
6A	15	11	1	2	0	0
6B	15	11	1	2	0	0
6C	15	11	1	2	0	0
7	30	23	1	2	0	0
8	15	11	1	2	0	0
9	15	11	1	2	0	0

[a] Direct effects includes both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

[c] Delta button celery habitat includes both alkali seasonal wetlands and valley/foothill riparian. Habitat effects for the species can be found in both Tables 12-ES-9 and 12-ES-11.

1 **Table 12-ES-12. Direct Effects of Alternatives on Tidal Wetland Plant Species in the Terrestrial Biological Study Area (acres and occurrences)[a]**

	Modeled Habitat (acres)					Occurrences							
Alternative[b]	Delta mudwort/ Mason's lilaeopsis	Side-flowering skullcap	Soft bird's-beak	Delta tule pea/Suisun Marsh aster	Suisun thistle	Delta mudwort	Delta tule pea	Mason's lilaeopsis	Side-flowering skullcap	Soft bird's-beak	Suisun Marsh aster	Suisun thistle	Bolander's water hemlock
1A	48	10	73	3	73	3	25	23	0	7	27	0	3
1B	53	13	73	5	73	3	28	18	2	7	27	0	3
1C	41	22	73	1	73	3	26	17	0	7	27	0	3
2A	50	7	73	3	73	3	25	23	0	7	27	0	3
2B	58	12	73	5	73	3	28	18	2	7	27	0	3
2C	41	22	73	1	73	3	26	17	0	7	27	0	3
2D	37	4	0	2	0	0	0	8	1	0	3	0	0
3	41	7	73	3	73	3	25	23	0	7	27	0	3
4	62	17	73	4	73	3	26	23	1	7	29	0	3
4A	37	7	0	2	0	0	0	8	1	0	3	0	0
5	37	7	73	3	73	3	11	15	0	3	14	0	2
5A	28	2	0	2	0	0	0	6	1	0	3	0	0
6A	48	10	73	3	73	3	25	23	0	7	27	0	3
6B	53	13	73	5	73	3	28	18	2	7	27	0	3
6C	41	22	73	1	73	3	26	17	0	7	27	0	3
7	45	12	73	4	73	3	25	23	0	7	27	0	3
8	48	10	73	3	73	3	25	23	0	7	27	0	3
9	163	173	73	26	73	10	30	27	2	7	27	0	3

[a] Direct effects includes both permanent and temporary.
[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate. corridors (Alternative 9).

Table 12-ES-13. Direct Effects of Alternatives on Inland Dune Plant Species in the Terrestrial Biological Study Area (occurrences)[a]

	Occurrences				
Alternative[b]	Hoover's cryptantha	Antioch Dunes wild-buckwheat	Mt. Diablo wild-buckwheat	Contra Costa wallflower	Antioch Dunes evening-primrose
1A	0	0	0	0	0
1B	0	0	0	0	0
1C	0	0	0	0	0
2A	0	0	0	0	0
2B	0	0	0	0	0
2C	0	0	0	0	0
2D	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
4A	0	0	0	0	0
5	0	0	0	0	0
5A	0	0	0	0	0
6A	0	0	0	0	0
6B	0	0	0	0	0
6C	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0

[a] Direct effects includes both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

Table 12-ES-14. Direct Effects of Alternatives on Nontidal Wetland Plant Species in the Terrestrial Biological Study Area (occurrences)[a]

Alternative[b]	Occurrences					
	Watershield	Bristly sedge	Woolly rose-mallow	Eelgrass pondweed	Sanford's arrowhead	Marsh skullcap
1A	1	2	13	0	2	0
1B	0	4	15	0	3	0
1C	0	0	4	1	1	0
2A	1	2	13	0	2	0
2B	0	4	15	0	3	0
2C	0	0	4	1	1	0
2D	1	2	13	0	1	0
3	1	2	12	0	2	0
4	1	3	15	0	2	0
4A	1	3	14	0	1	0
5	1	2	8	0	2	0
5A	1	2	8	0	1	0
6A	1	2	13	0	2	0
6B	0	4	15	0	3	0
6C	0	0	4	1	1	0
7	1	2	13	0	2	0
8	1	2	13	0	2	0
9	0	1	14	1	2	1

[a] Direct effects includes both permanent and temporary.

[b] Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors (Alternative 9).

12.1 Environmental Setting/Affected Environment

This section describes the environmental setting/affected environment for the terrestrial biological resources present in the chapter study area (the area in which impacts may occur). The chapter study area is slightly larger than the BDCP Plan Area because the study area encompasses the Plan Area and two potential transmission corridors outside of the Plan Area referred to as "Areas of Additional Analysis" in the remainder of the chapter (see Figure 12-1). The section presents the natural communities and other land cover types, the special-status and common terrestrial wildlife and plants, and the terrestrial invasive plants found in the study area. A brief discussion of the historical modifications of ecosystem processes and functions of the Plan Area is also included because it is crucial to an understanding of the current status of natural communities and terrestrial plants and wildlife addressed in the BDCP. The common and scientific names of special-status plant and wildlife species mentioned in this chapter and their association with natural communities and other land cover types of the study area are included in Tables 12-2 and 12-3 in Section 12.1.3, *Special-Status Species*. The common and scientific names and legal status of all special-status plant and wildlife species with potential to occur in the study area are listed in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*. All common and special-status species mentioned in this chapter are listed in Appendix 12B, *Common and Scientific Names of Terrestrial Species.*

Both the setting and the impact analysis contained in this chapter are focused on the geographic areas proposed for construction of water conveyance facilities and on the areas identified in the BDCP as most likely to support habitat restoration, enhancement and protection. These geographic areas have been characterized as conservation zones (CZs) that encompass the entire Plan Area, and, for tidal marsh and floodplain restoration, as restoration opportunity areas (ROAs) that focus on smaller regions of the Plan Area (see Figure 12-1). CZs were established to focus specific conservation efforts on portions of the Plan Area that have similar landscape characteristics and that represent logical geographic and landform divisions. ROAs were established to identify those locations considered to be the most appropriate for the restoration of tidal habitats and floodplains within the Plan Area and within which restoration goals for tidal and associated upland natural communities would be achieved. The ROAs are large land areas centered on Suisun Marsh, the west and south Delta areas, Cache Slough, and the Cosumnes/Mokelumne area in the east Delta (see Figure 12-1). These landscape divisions are described in more detail in BDCP Chapter 3, Section 3.2.2, *Identifying Conservation Zones and Restoration Opportunity Areas*. The Areas of Additional Analysis are not included in either the CZs or the ROAs.

12.1.1 Historical Trends in Biodiversity of the Plan Area

As described in Chapter 3, *Description of Alternatives*, and shown on Figure 3-1, the Plan Area consists of the statutory Delta, the Suisun Marsh and Yolo Bypass. Historical modifications of ecosystem processes and functions in the Plan Area have had a great influence on the current conditions of natural communities and special-status species. These changes to the ecosystem are discussed in Chapter 11, *Fish and Aquatic Resources*. A brief overview of major historical trends in terrestrial biodiversity is provided below.

The abundance of native wildlife and plant species has been reduced over time as a result of the extensive historical modifications to and loss of the habitats in the Plan Area. Because of habitat loss, large mammal species, such as tule elk, have been extirpated, and small mammal species, such as riparian brush rabbit, have been reduced in number and now occur only in scattered locations. The remnant marshes are now habitat for several species listed by the California Department of Fish and Wildlife (CDFW) as rare, threatened, or endangered, such as the California black rail and Mason's lilaeopsis. Nevertheless, the Plan Area lies in a central portion of the Pacific Flyway and continues to provide vital migratory, wintering, and breeding habitat for migratory birds, especially in designated wildlife management areas (e.g., Suisun Marsh and Yolo Bypass), where habitat management is optimized for managed species, including waterfowl, shorebirds, and wading birds. For example, although waterfowl have been reduced in numbers, the Delta still provides habitat for 26 species of wintering waterfowl (Bay Institute 1998). The Pacific Flyway is also particularly important for shorebirds and neotropical migratory birds.

Although fragmented, limited riparian habitat remains in the Plan Area. Remnant patches of tall riparian trees, such as Fremont cottonwood, western sycamore, and Goodding's black willow, occur, but the reproduction of these species is greatly impaired by lack of active floodplain habitat and hydrologic modifications (e.g., straightened and dredged channels, levees separating riparian vegetation from channel). The number of species of nesting birds and mammals found in the Plan

Area that depend on riparian habitat has declined during the last 150 years (Bay Institute 1998). Reports from early explorers describe the Delta and adjacent lands as an area with much greater wildlife species diversity than is currently found (Bay Institute 1998).

Grasslands with vernal pools support high levels of endemic biodiversity in the Central Valley (Witham et al. 1998 and references therein). This habitat type occurs in the northeast and southwest areas of the Plan Area. The vernal pool landscape in the northeast Plan Area has been affected by leveling for agricultural land uses (e.g., Stone Lakes National Wildlife Refuge [NWR]). The alkali grassland that supports vernal pools in the southwest Plan Area has been fragmented by agricultural and residential development and by water management projects. Only limited habitat remains for vernal pool species, such as fairy shrimp and native plants. It is estimated that throughout the Central Valley, the acreage of grasslands with vernal pools has declined from 7 million acres during the 1700's to about 895,000 acres in 2005 (Holland and Hollander 2007; Holland 2009). Approximately 135,000 acres were estimated to have been lost from 1976 to 2005. (Holland 2009).

Most of the land in the Plan Area has been converted to agricultural land uses, which provide limited habitat value to most species. However, some species, including Swainson's hawk and greater sandhill crane, use the alfalfa and field crop areas for foraging. Besides changing land use, agricultural practices can include 1) building levees, which modify hydrology, 2) applying pesticides and fertilizers, which alters surface and groundwater quality (see Chapter 6, *Surface Water*) and may be toxic to certain species, and 3) other activities that can be detrimental to native plant and wildlife habitat.

12.1.2 Land Cover Types

The land cover types discussed in this chapter are derived from various sources. Within the Plan Area, these cover types are based on the natural communities that are defined and delineated in the BDCP for the purposes of the NCCP component of the Plan (see BDCP Chapter 2, Section 2.3.4, *Natural Communities*). For the two portions of the study area that extend beyond the Plan Area boundary, the natural communities were mapped using a series of mapped datasets, reports and aerial imagery prepared by the U.S. Department of Agriculture (USDA), the U.S. Geological Survey, CDFW, and other agencies. Natural communities within the study area are mapped in Figure 12-1. The description of each natural community below includes a discussion of how that natural community functions as habitat for common and special-status terrestrial plants and wildlife. Semiaquatic wildlife and plant species and their habitats are also discussed, as appropriate. Although there is some overlap in the discussion with Chapter 11, *Fish and Aquatic Resources*, this section explains how aquatic areas provide habitat for primarily terrestrial plants, vernal pool and seasonal wetlands (other than vernal pools) invertebrates, amphibians, reptiles, birds, and terrestrial mammals. Also discussed in this section are cultivated lands and developed lands, which are not natural communities but which do provide certain types of habitat and are, therefore, included with the natural communities.

12.1.2.1 Natural Community Mapping Methods

The discussion of natural communities is based, in part, on BDCP Chapter 2, *Existing Ecological Conditions*. Background data for the BDCP were collected through an extensive search of various sources, including current scientific literature (e.g., journal articles, conference proceedings, and textbooks), published reports, technical documents, and agency-maintained data (e.g., data maintained by the Interagency Ecological Program, CDFW, California Department of Water Resources [DWR], and other agencies). Natural communities were generally defined and described using the Multi-Species Conservation Strategy (CALFED Bay-Delta Program 2000).

The natural communities were delineated in the Delta using the vegetation and land use classification developed for the Delta by CDFW (Hickson and Keeler-Wolf 2007). Vegetation in the legal Delta, excluding parts of Chipps and Van Sickle islands, was classified and mapped by CDFW during 2005–2006 for use in the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). Vegetation was sampled according to the California Native Plant Society (CNPS) Rapid Assessment Protocol. The CDFW system follows Sawyer et al. (2009), which is consistent with the National Vegetation Classification System for the United States (Grossman et al. 1998).

A “crosswalk” table was developed by CDFW between the fine-scale vegetation types classified and mapped by CDFW during 2005–2006 and the corresponding broad biological community classifications used in the BDCP. Polygons from the fine-scale CDFW map were combined using a geographic information system (GIS). The portion of the Plan Area not sampled by CDFW during the Delta mapping project was delineated by SAIC ecologists and entered into a GIS using 2005 USDA Farm Service Agency National Agriculture Imagery Program (NAIP) color aerial photography with 1-meter (3.3-foot) resolution. This imagery was photographically interpreted to identify the natural communities present in portions of the Plan Area that were not sampled by CDFW.

Natural communities in Suisun Marsh and on Chipps and Van Sickle islands were delineated in 2006 by Boul and Keeler-Wolf (BDCP Chapter 2, *Existing Ecological Conditions*). Vegetation types in Suisun Marsh were primarily determined by wetland management strategies. These strategies were used to combine the CDFW Suisun Marsh vegetation types into BDCP natural communities, in combination with the San Francisco Estuary Institute’s EcoAtlas GIS dataset. The resulting categorized Suisun Marsh vegetation dataset was then compared with NAIP 2005 aerial imagery by ecologists preparing the BDCP and refined as necessary. Subsequently, the dataset was merged with the BDCP Delta natural community type cover dataset.

Instead of using the Yolo County Natural Heritage GIS data to represent crop types in the upper Yolo Bypass north of I-80, the DWR land use survey data for Yolo County from 2008 were used to assign crop types to the cultivated lands land cover type dataset. The DWR land use dataset was not available when the BDCP vegetation dataset was originally created. To maintain consistency when and where possible within the crop type classifications, the DWR dataset was used in place of the Yolo County data (see BDCP Appendix 2.B, *Vernal Pool Complex Mapping and Modifications to Natural Community Mapping*).

Data from the South Sacramento Habitat Conservation Plan (SSHCP) and modified by ICF biologists as necessary following a review of USDA data and Google Earth imagery was used to define vegetation cover for the eastern Area of Additional Analysis. Agricultural areas were defined based on DWR land cover information. The SSHCP and DWR land cover data were crosswalked to the BDCP natural community types.

The western Area of Additional Analysis was mapped by ICF biologist and GIS specialists using USDA imagery and 2012 Google Earth imagery. The mapped areas were then ground truthed by ICF biologists in May 2012 to verify the accuracy of the GIS mapping and to further refine the agricultural classifications.

In addition, a separate dataset was generated to describe vernal pool characteristics present in the Plan Area. Vernal pool complexes were identified and mapped with the help of aerial photographs; existing vernal pool GIS data sets; California Natural Diversity Database (CNDDB) records of vernal pool species; and topographic data, using Light Detection and Ranging (LiDAR). See BDCP Chapter 2, *Existing Ecological Conditions*, for a detailed methods description.

A mapping effort independent of natural communities mapping was conducted for wetlands and open water that are regulated as jurisdictional wetlands by Section 404 of the Clean Water Act. This mapping effort was designed to aid in future permitting processes for BDCP planned actions, specifically construction of the water conveyance facilities. The mapping methodology and wetlands nomenclature is distinctly different from that used in the natural communities analysis for the BDCP and this document. The methods used to conduct this mapping are described in Section 12.3.2.4. The results of this mapping and the relationship between BDCP implementation and these jurisdictional wetlands is described in detail in the General Terrestrial Biological Effects sections of each alternative analysis later in this chapter (see Section 12.3.3, *Effects and Mitigation Approaches*, and Section 12.3.4, *Effects and Mitigation Approaches—Alternatives 4A, 2D, and 5A*).

12.1.2.2 Special-Status and Other Natural Communities

Twelve of the natural community types occurring in the study area are, for the purposes of this EIR/EIS, identified as special-status natural communities. These communities are considered special status because they include specific vegetation alliances that are recognized by CDFW as of limited distribution statewide or within a county or region (CNDDB Rank of S1–S3), or because they require focused analysis under these federal and state laws and regulations:

- CEQA.
- Section 1602 of the California Fish and Game Code.
- Section 404 of the Clean Water Act (CWA).
- California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

These laws and regulations are discussed in Section 12.2, *Regulatory Setting*. Special-status natural communities may be of special concern to resource agencies and conservation organizations for a variety of reasons, including their locally or regionally declining status or because they provide important habitat to common and special-status species. Many of these habitats are monitored and reported in the CNDDB, which is maintained by CDFW. The following natural communities, all of which are found within the study area, are considered special-status natural communities.

- Tidal Perennial Aquatic
- Tidal Mudflat
- Tidal Brackish Emergent Wetland
- Tidal Freshwater Emergent Wetland
- Valley/Foothill Riparian
- Nontidal Perennial Aquatic
- Nontidal Freshwater Perennial Emergent Wetland
- Alkali Seasonal Wetland Complex

- Vernal Pool Complex
- Managed Wetland
- Other Natural Seasonal Wetland
- Inland Dune Scrub

Of these twelve natural communities, all but the inland dune scrub have elements of aquatic habitat or potential aquatic habitat (valley/foothill riparian) protected under the CWA and Porter-Cologne Act. The regulated aquatic resources have been grouped into the following wetland and open water categories (the hydrology-based wetland types originally mapped for the Draft EIR/EIS have been reclassified into the following habitat-based types to facilitate the permitting process).

- Wetlands
  - Perennial
    - Emergent
    - Scrub-Shrub
    - Forest
  - Seasonal
    - Vernal Pool
    - Seasonal wetland
    - Alkaline Wetland
- Other Waters of the United States
  - Nontidal
    - Agricultural Ditch
    - Natural Channel
    - Pond
    - Lake
  - Tidal
    - Tidal Channel
    - Conveyance
    - Clifton Court Forebay

Impacts on waters of the United States discussed in Section 12.3.3, *Effects and Mitigation Approaches*, and Section 12.3.4, *Effects and Mitigation Approaches—Alternatives 4A, 2D, and 5A*, are presented in the Wetlands and Other Waters of the United States categories listed above. These groupings ensure that impacts are assessed, and mitigation assigned, to categories of aquatic resources typically required by regulatory agencies.

One other natural community (grassland) and two land cover types (cultivated lands and developed lands) also are present in the study area but are not considered special-status natural communities. Though some grasslands, cultivated lands, and developed lands provide habitat for special-status species, as a natural community and a land cover type these areas are not of limited distribution and do not in themselves require particular regulatory consideration for the vegetation that occurs there (e.g., these areas are not regulated wetlands). Throughout the remainder of the chapter, these three community/land cover types are addressed in the context of the other natural communities. The cultivated lands land cover type is treated as a natural community in the BDCP to meet the requirements of the NCCPA and to recognize its value to covered species addressed in the Plan. Tidal mudflat, which is listed above, is not mapped separately, and occurs at the edges between tidal perennial aquatic, tidal freshwater emergent, and tidal brackish emergent wetland. Therefore, the tidal mudflat natural community is not addressed separately in detail in this chapter.

The study area natural communities are described below, including how each is used by common and special-status plant and wildlife species. Information on natural communities and associated plant and wildlife species was summarized from BDCP Chapter 2, Section 2.3.4, *Natural Communities*. Table 12-2 and Table 12-3 list the special-status species (covered and noncovered species) supported by these natural communities. The acreages of each natural community within the Plan Area and this chapter's study area are presented in Table 12-1.

Table 12-1. Area (in acres) of Natural Community Types in the Terrestrial Biology Study Area

Natural Community Type	Plan Area	Areas of Additional Analysis	Study Area Total	Percentage of the Study Area
Tidal Perennial Aquatic	86,263	0	86,263	10
Tidal Brackish Emergent Wetland	8,501	0	8,501	<1
Tidal Freshwater Emergent Wetland	8,856	0	8,856	1
Valley/Foothill Riparian	17,644	322	17,966	2
Nontidal Perennial Aquatic	5,489	78	5,567	<1
Nontidal Freshwater Perennial Emergent Wetland	1,385	124	1,509	<1
Alkali Seasonal Wetland Complex	3,723	0	3,723	<1
Vernal Pool Complex	11,284	849	12,133	1
Managed Wetland	70,698	100	70,798	8
Other Natural Seasonal Wetland	276	566	842	<1
Grassland	76,315	1,732	78,047	9
Inland Dune Scrub	19	0	19	<1
Cultivated Lands	481,909	5,197	487,106	56
Developed	90,278	382	90,660	10
Total	**862,640**	**9,350**	**871,990**	**100.0**

Tidal Perennial Aquatic

The tidal perennial aquatic natural community is defined as deep-water aquatic (greater than 10 feet deep from mean lower low tide [i.e., 19-year average of the lowest of the two low tides during the daily tidal cycle]) and shallow aquatic (less than or equal to 10 feet deep from mean lower low tide) zones of estuarine bays, river channels, and sloughs. Under present operations, tidal perennial aquatic in the Delta is mainly freshwater habitat, with brackish and saline conditions occurring in the western Delta (CZs 5 and 10) at times of high tides and low flows into the western Delta. It is freshwater in the Yolo Bypass (CZ 2) and mainly brackish and saline in Suisun Marsh (CZ 11).

Eight plant community alliances (i.e., unique species assemblages) mapped in the Plan Area occur within the tidal perennial aquatic natural community (Hickson and Keeler-Wolf 2007). (A comparison table "crosswalk" for the alliances that make up the tidal perennial aquatic community can be found in BDCP Chapter 2, Section 2.3.4, *Natural Communities*.) Aquatic vegetation in the study area can be separated into two general categories: floating aquatic vegetation and submerged aquatic vegetation (Cowardin et al. 1979). The geographic extent of this vegetation changes frequently because it depends on highly variable physical factors, such as depth, turbidity, water flow, salinity, substrate, and nutrient availability.

Floating aquatic vegetation extends over the open water surface, either as free-floating plants or as colonies extending from plants rooted in banks. Most floating aquatic vegetation in the Delta consists of highly invasive nonnative plants such as water hyacinth, which commonly occurs in dense floating mats thick enough to create anoxic conditions in ditches and canals.

Floating aquatic vegetation also occurs in sloughs, especially near their source of origin where flows are slow. Abundant floating aquatic vegetation frequently presents a nuisance to boaters. Even native floating aquatic species may become overabundant and invasive in nutrient-rich waters of urban and agricultural watersheds with diminished tidal and freshwater outflows. Floating aquatic vegetation borders marshes along large sloughs and small tidal channels in the Delta and may accumulate in such large quantities that it may affect marsh vegetation by smothering it with decomposing masses of debris.

Submerged aquatic plants have leaves and stems that are fully submerged for all or nearly all of their life-cycle, and they often have root systems reduced to minimal anchorage structures in pond or river beds. Many native submerged aquatic species, including pondweeds (e.g., sago pondweed) and stoneworts (green algae structurally similar to vascular plants), are highly valuable food plants for waterfowl and nursery habitat for aquatic invertebrates and fish. Submerged aquatic vegetation may form patches or beds of extensive bottom "canopy" habitat. In the Delta, nonnative invasive submerged aquatic species dominate and replace native species in naturally open water slough beds. Brazilian waterweed, also known as *Egeria*, is invasive and extremely competitive with native species, and it is capable of surviving at great water depths. It has structural characteristics that create suitable cover and shelter for predatory nonnative fish in tidal slough beds. Restoration of shallow or deep subtidal habitats in the Delta may be viewed unfavorably because of Brazilian waterweed, which is rapidly established in these habitats.

Aquatic plant communities that are dominated by native species would be considered special-status communities because they provide suitable habitat for special-status plants and animals. These communities would, in most cases, be considered jurisdictional waters of the United States and regulated by the U.S. Army Corps of Engineers (USACE) under Section 404 of the CWA. They would also be regulated by a California Regional Water Quality Control Board (RWQCB) as waters of the state under the Porter-Cologne Act.

Wildlife species associated with tidal aquatic habitats vary with water depth and other habitat features. Deeper open water areas without vegetation provide foraging habitat for wildlife such as terns, gulls, osprey, diving ducks, such as ring-necked duck and canvasback, and river otters, which feed primarily on fish, crayfish, and other aquatic organisms. Shallower water with submerged or floating aquatic vegetation provides foraging habitat for reptiles, such as western pond turtle, and dabbling ducks, such as American widgeon and Northern pintail, which feed on a variety of invertebrates and plant material. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the tidal perennial aquatic natural community. The community's distribution in the study area is mapped in Figure 12-1.

Tidal Mudflat

The tidal mudflat natural community typically occurs as sediments in the intertidal zone between the mean high tide and the mean lower low tide. This natural community is exposed above water at low tide and is typically associated with tidal freshwater emergent wetland or tidal brackish emergent wetland at its upper edge. Because tidal mudflat has been mapped as part of the tidal perennial aquatic, tidal brackish emergent wetland and tidal freshwater emergent wetland communities, it is not shown on Figure 12-1 or listed in Tables 12-1, 12-2, or 12-3. Tidal mudflat can be found throughout the study area but differs slightly in nature in the Suisun Marsh (CZ 11) and in the Delta because physical factors, such as rates of sediment erosion and deposition and duration of tidal inundation, vary. Tidal mudflat is a special-status natural community because activities within this community would be regulated as wetlands by Section 404 of the CWA and waters of the state under the Porter-Cologne Act.

Tidal mudflat is important habitat for two of the covered plant species: Mason's lilaeopsis and Delta mudwort (Fiedler and Zebell 1993; Witham and Kareofelas 1994). Suisun marsh aster, another covered species, is also found on tidal mudflats in the Delta. A great abundance and diversity of invertebrates are found at varying depths in the substrate, and they support a variety of foraging shorebirds, wading birds, and dabbling ducks, such as western sandpiper, dunlin, long- and short-billed dowitchers, whimbrel, long-billed curlew, great egret, black-crowned night-heron, cinnamon and green-winged teal, and mallard. As the tide rises and mudflats are inundated with deeper water, wildlife species composition shifts to species described above for submerged aquatic vegetation.

Tidal Brackish Emergent Wetland

The tidal brackish emergent wetland natural community is a transitional community between tidal perennial aquatic and terrestrial upland communities. In the study area, tidal brackish emergent wetland exists in the San Francisco Bay saltwater/Delta freshwater mixing zone that extends from near Collinsville (CZs 5, 10, and 11) westward to the Carquinez Straight. Tidal brackish emergent wetland is present on the south side of Suisun Bay and on islands in midchannel but is most extensive in Suisun Marsh (CZ 11). The distribution of tidal brackish emergent wetland in the study area is shown on Figure 12-1.

The tidal brackish emergent wetland community in the study area is found in undiked areas of Suisun Marsh, such as Rush Ranch and Hill Slough; along undiked shorelines on the south shore of Suisun Bay; and on undiked in-channel islands, such as Browns Island. Eight plant community alliances mapped in the Plan Area fall within the tidal brackish emergent wetland natural community (Hickson and Keeler-Wolf 2007; Keeler-Wolf and Vaghti 2000).

Tidal brackish emergent wetland in the study area is characterized by tall herbaceous wetland plant species that line the channels down to the depth of mean lower low tide. Dominant plant species include hard-stem bulrush, California bulrush, common reed, and cattail (Suisun Ecological Workgroup 1997; Grewell et al. 2007). Dominant species present between the channels and the marsh plain include pickleweed, saltgrass, saltmarsh dodder, spearscale, and Baltic rush. Tidal brackish emergent wetland in the Suisun Marsh area is habitat for several special-status plant species: soft bird's-beak and Suisun thistle, both federally listed as endangered, and Suisun Marsh aster, San Joaquin spearscale, and Bolander's water-hemlock. Channels in tidal brackish emergent wetland may be flooded or exposed, depending on tidal stage. The marsh plain is usually free of standing water but may be flooded at very high tides. Wildlife use of channels is similar to that of tidal mudflats and in some cases tidal perennial aquatic, especially in larger channels. On the marsh plain and in channels with vegetative cover, typical wildlife present include ornate shrew, song sparrow, and red-winged blackbird. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the tidal brackish emergent wetland natural community. The community's distribution is mapped in Figure 12-1. Tidal brackish emergent wetland is a special-status natural community because activities within this community would be regulated as wetlands by Section 404 of the CWA and as waters of the state under the Porter-Cologne Act.

Tidal Freshwater Emergent Wetland

The tidal freshwater emergent wetland natural community is typically a transitional community between tidal perennial aquatic and valley/foothill riparian or terrestrial upland communities across a range of hydrologic and soil conditions. In the study area, the tidal freshwater emergent wetland community often occurs at the shallow, slow-moving or stagnant edges of freshwater waterways or ponds in the intertidal zone and is subject to frequent long-duration flooding. The distribution of tidal freshwater emergent wetland in the study area is shown on Figure 12-1.

Tidal freshwater emergent wetland vegetation naturally occurs along a hydrologic gradient in the transition zone between open water and riparian vegetation or upland terrestrial vegetation such as grasslands or woodlands. In the study area, there are abrupt transitions to agricultural cover, managed wetlands, and boundaries formed by levees and other artificial landforms. Seventeen plant community alliances mapped in the Plan Area fall within the tidal freshwater emergent wetland natural community (Hickson and Keeler-Wolf 2007).

Tidal freshwater emergent wetland is regularly and occasionally flooded tidal marshlands with very low levels of soil salinity. These communities can be categorized based on their frequency of inundation. The low elevation tidal freshwater emergent wetland is influenced by the daily tides and is flooded more times than not. Middle-elevation tidal freshwater emergent wetland is regularly flooded, but the soil is exposed above the water level for many hours each day. High-elevation tidal freshwater emergent wetland is occasionally flooded by tides or flood events but includes depressions that remain flooded after tides recede.

Low-elevation tidal freshwater emergent wetland typically is dominated by tules and occasionally includes species of cattails. They are highly productive but support few species other than tules that tolerate deep, prolonged tidal flooding. The middle-elevation tidal freshwater emergent wetland is more diverse in plant species (e.g., bur-reed, broadleaf arrowhead, and water smartweed), even though this community may also be dominated by tules.

Middle-elevation tidal freshwater emergent wetland is less abundant than low-elevation tidal freshwater emergent wetland and often represents a more mature marsh condition with long periods of peat accumulation or sediment deposition. Much of this plant community has been converted to other land uses, such as agriculture. Invasive nonnative plants, such as yellow flag iris and purple loosestrife, tend to invade this species-rich freshwater zone. The middle-elevation tidal freshwater emergent wetland zone grades into the uppermost end of tidal freshwater marsh (high-elevation intertidal marsh zone). This high-elevation type of tidal freshwater marsh is also rare but is well developed in a few locations in the Delta.

The high-elevation tidal freshwater emergent wetland zone can be dominated by grass and grasslike species, such as Baltic rush, creeping wildrye, and saltgrass. It typically includes large patches of yerba mansa and wild heliotrope. Special-status plant species commonly found in this plant community include Suisun marsh aster and woolly rose-mallow. Large thickets of nonnative Himalayan blackberry invade high-elevation tidal freshwater emergent wetland, converting the marsh to riparian scrub thickets. High-elevation tidal freshwater emergent wetland may naturally grade into low-elevation grasslands (dense stands of saltgrass and creeping wildrye) or seasonal wetland transition zones, or it may end abruptly at the edges of steep levees or eroded riverbanks.

Wildlife species composition in sparsely vegetated areas in low-elevation tidal freshwater emergent wetland is similar to the composition described above under tidal perennial aquatic and tidal mudflat. Other wildlife that use these productive wetlands as foraging habitat and the dense vegetation as cover, especially in the low- and middle-elevations, include western pond turtle, wading birds (egrets and herons), waterfowl (ducks, geese, and swans), shorebirds (e.g., rails, plovers, sandpipers), and perching birds. Common nesting birds include red-winged blackbird, marsh wren, common yellowthroat, and black-crowned night-heron. American beaver and muskrat forage on marsh plants and use them for cover and den material. Tables 12-2 and 12-3 list the special-status plant and wildlife species supported by the tidal freshwater emergent wetland natural community.

Most wetlands in this category would qualify as wetlands subject to USACE jurisdiction under Section 404 of the CWA. All tidal freshwater emergent wetland would be considered waters of the state and be regulated under the Porter-Cologne Act. If located adjacent to a stream or lake, it would also be subject to regulation under Section 1602 of the California Fish and Game Code.

Valley/Foothill Riparian

Broadly defined, the valley/foothill riparian natural community is often a transition zone between aquatic and upland terrestrial habitat and is found in a wide range of geologic, soil, and other environmental conditions (e.g., variable light and nutrient availability) throughout the study area (Bay Institute 1998; Vaghti and Greco 2007). The current extent of the valley/foothill riparian community represents a small proportion of its historical extent in the study area. Historically, valley/foothill riparian vegetation was distributed along all major and minor waterways and floodplains throughout the study area (Bay Institute 1998). The loss of riparian vegetation throughout California, estimated to be 85%–95%, was caused by human activities, such as river and stream channelization, levee building, vegetation removal to stabilize levees, and extensive agricultural and urban development (Riparian Habitat Joint Venture 2004).

Valley/foothill riparian communities occur in the study area most often as long, linear patches separating other terrestrial biological communities and agricultural or urban land, or in low-lying, flood-prone patches near river bends, canals, or breached levees (Figure 12-1). An exception is in conservation areas where large tracts of riparian forest are being restored, such as the Cosumnes River Preserve. Generally, however, this natural community is located along many of the major and minor waterways, oxbows, and levees in the study area, including the Sacramento River (CZs 3, 4, and 5), the Sacramento River Deep Water Ship Channel (CZs 2 and 3), the Yolo Bypass (CZ 2), and channels of the San Joaquin River and the Delta (CZs 5, 6, and 7). Patches of riparian vegetation are also found on the interior of leveed Delta islands, along drainage channels and pond margins, and in abandoned, low-lying fields.

CDFW identified 41 plant community alliances in the Delta that fall within the valley/foothill riparian natural community (Hickson and Keeler-Wolf 2007). These assemblages are discussed below in general terms under the riparian scrub, and riparian forest and woodland subcategories. Tables 12-2 and 12-3 list the special-status plant and wildlife species supported by the valley/foothill riparian natural community. The community is mapped in Figure 12-1.

Riparian Scrub

Riparian scrub in the study area consists of woody riparian shrubs forming dense thickets. Species may include willows, blackberries, buttonbush, mulefat, and other shrub species. These thickets are usually associated with higher, sloping, better-drained edges of marshes, or topographic high areas, such as levee remnants and elevated flood deposits. Thickets may occur along shorelines of ponds or banks of channels in tidal or nontidal freshwater habitats. Willow thickets and dead branches or trees (snags) in riparian woodland provide important habitat for a wide range of wildlife species. During extreme floods, dense and tall riparian willow thicket canopies may remain partially above water levels, trap debris and sediment, and act as permeable barriers to wave energy traveling across open water. Nonnative Himalayan blackberry thickets are a common element of riparian scrub communities along levees and throughout pastures within the levees.

Riparian scrub is considered a special-status natural community because this community supports a range of sensitive species, has overall importance to biodiversity, and is subject to CDFW regulation under Section 1602 of the California Fish and Game Code and Fish and Game Code Section 3503 when nesting bird species are present. Riparian scrub located in areas subject to frequent flooding or ponding also may qualify as wetlands subject to USACE jurisdiction under Section 404 of the CWA, and waters of the state under the Porter-Cologne Act.

Riparian Forest and Woodland

The study area supports winter-deciduous, broadleaved trees, up to 60 feet in height in the riparian forest and woodlands, where the canopy cover ranges from relatively open to very dense. At present, riparian forest and woodland communities dominated by tree species are mostly limited to narrow bands along sloughs, channels, rivers, and other freshwater features throughout the study area. Cottonwoods and willow mixed with Oregon ash, box elder, and California sycamore are the most common riparian trees in central California. Valley oak is common in riparian areas in the Central Valley, as are species of walnut. Riparian woodland often has a shrubby understory consisting of the similar species discussed above in riparian scrub. Equivalent communities, as described by Holland (1986), include great valley cottonwood riparian forest, great valley mixed riparian forest, great valley oak riparian forest, and white alder riparian forest.

Riparian forest and woodland are considered sensitive natural communities because they are subject to CDFW regulations under California Fish and Game Code Section 1602 and Fish and Game Code Section 3503 when nesting bird species are present. Riparian forest and woodlands are also considered sensitive communities because they have sustained considerable losses throughout the state. Riparian habitat supports a wide variety of wildlife species. Riparian trees are used for nesting, foraging, and protective cover by many bird species, including black-headed grosbeak, tree swallow, Bewick's wren, and Cooper's hawk. Riparian canopies provide nesting and foraging habitat for common mammals, such as western gray squirrel. Understory shrubs provide cover for mammals such as desert cottontail and for ground-nesting birds, such as spotted towhee, that forage among the vegetation and leaf litter. Mammals such as raccoon and opossum benefit from the variety of berries, invertebrates, small mammals, and bird eggs that provide food.

Nontidal Perennial Aquatic

Nontidal perennial aquatic natural communities in the Delta can range in size from small ponds in uplands to large lakes, such as North and South Stone Lakes (CZ 4). The nontidal perennial aquatic natural community can be found in association with any terrestrial habitat and can transition into nontidal freshwater perennial emergent wetland and valley/foothill riparian. This natural community is differentiated from the tidal perennial aquatic natural community described above by a physical separation from the tidally influenced sloughs and channels in the Delta.

Dominant plant species present in the nontidal perennial aquatic natural community include most of the species mentioned above for the tidal perennial aquatic natural community, including floating water primrose, water hyacinth, and Brazilian waterweed. Vegetation in nontidal perennial aquatic can be similarly characterized as floating aquatic vegetation and submerged aquatic vegetation (see description above).

Nontidal perennial aquatic communities provide foraging habitat and winter roosting habitat for wildlife that depends on other habitats for breeding and cover. Typical species include pied-billed grebe, western grebe, ruddy duck, canvasback, bufflehead, and river otter. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the nontidal perennial aquatic natural community. The community is mapped in Figure 12-1. The nontidal perennial aquatic community is a special-status natural community because activities within this community would be regulated as wetlands by Section 404 of the CWA and waters of the state under the Porter-Cologne Act. When this community is associated with a lake or stream, it may also be regulated under Section 1602 of the California Fish and Game Code.

Nontidal Freshwater Perennial Emergent Wetland

The nontidal freshwater perennial emergent wetland community is composed of permanently saturated wetlands, including meadows, dominated by emergent plant species that do not tolerate permanent saline or brackish conditions (CALFED Bay-Delta Program 2000). Nontidal freshwater perennial emergent wetland communities in the study area occur in small fragments along the edges of the nontidal perennial aquatic and valley/foothill riparian natural communities (Figure 12-1). These emergent wetlands typically occur on the land side of the Delta levees. Shallow emergent wetlands (water less than 3 feet deep) are dominated by thick, tall, highly productive stands of tules and cattails.

Many of the nontidal freshwater perennial emergent wetland that occurs in the study area is disturbed, either through hydrologic disturbance or by physical disturbances. Broad, deeply flooded areas that are covered by open water most of the year and that develop emergent mud beds late in the growing season effectively alternate between seasonal ponds and freshwater marshes. Physical disturbance are direct, such as channel dredging, or indirect as a result of adjacent agricultural, commercial, or residential activities. Disturbed nontidal freshwater perennial emergent wetland that occurs in ditches supports a higher proportion of cattails than undisturbed nontidal freshwater marshes. Characteristic forbs and grasslike species associated with nontidal freshwater perennial emergent wetland include a mix of native and nonnative species, such as cocklebur, curly dock, several knotweed species, common spikerush, rabbit-foot grass, and dallisgrass. The higher elevation edges of freshwater marsh gradients may be characterized by abrupt transitions to terrestrial vegetation, or they may transition into vegetation of alkali seasonal wetlands, riparian woodland, or riparian scrub.

Nontidal freshwater perennial emergent wetland provides important foraging, breeding, and winter roosting habitat for a variety of wildlife species; dense emergent vegetation provides concealment from predators. Reptiles and amphibians associated with marsh habitats include common garter snake, Pacific chorus frog, and bullfrog. Locally common to abundant wading birds (egrets and herons), waterfowl (ducks, geese, and swans), shorebirds (e.g., rails, plovers, sandpipers), and perching birds (e.g., red-winged blackbird, marsh wren, common yellowthroat) use nontidal marsh habitat for foraging, cover, and nesting. American beavers and muskrats forage on marsh plants and use them for cover and den material. River otter forage on fish, amphibians, and invertebrates as well as use the cover provided by thickets and tall wetland plants. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the nontidal freshwater perennial emergent wetland natural community. The nontidal freshwater perennial emergent wetland community is a special-status natural community because activities within this community would be regulated as wetlands by Section 404 of the CWA and waters of the state under the Porter-Cologne Act. When this community is associated with a lake or stream, it may also be regulated under Section 1602 of the California Fish and Game Code.

Alkali Seasonal Wetland Complex

Alkali seasonal wetland complex occurs on alkaline soils with ponded or saturated soil conditions for prolonged periods during the growing season. The vegetation of alkaline seasonal wetlands is composed of salt-tolerant plant species adapted to wetland conditions and high salinity levels. This natural community “complex” includes both seasonally ponded and saturated wetlands and the surrounding matrix of grassland. It is typically found either at the historical locations of lakes or ponds in the Yolo Basin (CZ 2) in and around the CDFW Tule Ranch Preserve (Witham 2003) where salts accumulated through evaporation, or in upland locations, such as basin rims and seasonal drainages, that receive salts in runoff from distant upslope salt-bearing rock. Areas near Suisun Marsh (CZ 11) and the Clifton Court Forebay (CZ 8) are examples of the latter locations (Figure 12-1).

The composition of alkali seasonal wetland complex can be highly variable from site to site, and these wetlands may include species typically associated with the Holland communities of alkali grassland, alkali sink, chenopod scrub, brackish marsh, valley sink scrub, and alkaline vernal pools (Holland 1986). Alkaline seasonal wetlands can support a richness of species, and they often provide suitable habitat for a number of special-status plant species. Dominant grasses in alkaline seasonal wetlands and surrounding grassland include saltgrass and wild barley. The associated herb cover consists of salt-tolerant species, including saltbush, alkali heath, alkali weed, alkali mallow, and common spikeweed. The study area includes small stands of alkali sink scrub (also known as valley sink scrub), which are characterized by iodine bush. Alkali seasonal wetland complex is rare in the study area, occurring primarily around Clifton Court Forebay, southeastern Solano County, and in the Yolo Bypass.

Alkali seasonal wetland complex is considered a special-status community because it provides suitable habitat for many special-status plants and animals, and in many cases is considered jurisdictional wetlands regulated by USACE under Section 404 of the CWA, and waters of the state under the Porter-Cologne Act.

During winter and spring, when alkali seasonal wetlands are filled with water, plants, and aquatic life, the wetlands act as an important foraging habitat for a variety of common wildlife species, including great blue heron and great egret. Alkali seasonal wetlands support common wildlife species, including dabbling ducks, invertebrates such as various native bee species, and reptiles and amphibians, such as the common garter snake and Pacific chorus frog. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the alkali seasonal wetland complex natural community.

Vernal Pool Complex

The vernal pool complex natural community is characterized by interconnected and isolated groups of vernal pool wetlands and seasonal swales in the matrix of the grassland natural community (described below). The vernal pool complex community is rare in the study area and is generally contiguous with vernal pool habitat adjacent to the study area (Figure 12-1). It was mapped specifically for the BDCP using a range of methods because there were no available data sets with the appropriate level of detail or spatial extent. Details of the methods used to map the Vernal Pool Complex community are presented above in the introduction to Section 12.1.2.1, *Natural Community Mapping Methods*. In the study area, vernal pool grassland occurs in the vicinity of Stone Lakes NWR (CZ 4), Yolo Bypass (CZ 2), southeastern Solano County (CZ 1), Jepson Prairie, and Clifton Court Forebay (CZ 8).

Vernal pools are seasonal wetlands that form in shallow depressions underlain by hardpan or a dense clay subsurface layer. These depressions fill with rainwater and surface runoff; the subsurface layers restrict infiltration into the subsoil and the depressions remain inundated throughout the winter, and sometimes as late as early summer. Vernal pools are found in areas of level or gently undulating topography in the lowlands of California, especially in the grasslands of the Central Valley. Although these wetlands are typically small, some vernal pools can reach several acres in size. Rising spring temperatures cause the water in vernal pools to evaporate, promoting the growth of concentric bands of various plant species, especially native wildflowers, along the shrinking edge of the pool. Vernal pool vegetation in California is characterized by a high percentage of native species, several of which have restricted ranges. Many plant species, and a number of animal species associated with vernal pools, are federally or state listed as rare, threatened, or endangered.

Vernal pools and vernal pool grassland are considered special-status natural communities because they provide vital habitat for many special-status plants and animals. They are of concern to CDFW, and when they meet specific criteria established by USACE, they are considered jurisdictional wetlands under Section 404 of the CWA. The vernal pools could also be considered waters of the state under the Porter-Cologne Act.

During winter and spring, when vernal pools or seasonal wetlands are filled with water, plants, and aquatic life, they act as an important foraging habitat for a variety of common wildlife species, including great blue heron and great egret. Vernal pools and seasonal wetlands support common wildlife species, including dabbling ducks, invertebrates such as various native bee species, and reptiles and amphibians, such as the common garter snake and Pacific chorus frog. The uplands that surround vernal pools also provide habitat for pollinators of native vernal pool plants (e.g., solitary bees) as well as refugia for amphibian species that utilize these pools for breeding. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the vernal pool complex natural community.

Degraded vernal pools has been characterized as a subset of the vernal pool complex natural community for purposes of this EIR/EIS. This designation applies to those areas where vernal pool terrain was historically present but where the original topography has been disturbed by grading activities. These areas retain their seasonal hydrology—ponding water for extended periods during the rainy season—because the underlying claypan or hardpan soil layer characteristic of vernal pool complexes is still intact. They were identified where grasslands were underlain by soil types typical for vernal pools (see BDCP Chapter 2, Section 2.3.4, *Natural Communities*) but where interpretation of aerial photography showed disturbed topography and on-the-ground observations indicated that seasonal ponding is occurring and habitat for vernal pool species is present. Despite the disturbance, areas mapped as grassland with degraded vernal pools can still function as habitat for federally listed and state-listed vernal pool species. Tables 12-2 and 12-3 list special-status plant and wildlife species that could occur in degraded vernal pool grassland. These species are similar to those described for the vernal pool complex natural community.

Managed Wetland

The managed wetland natural community consists of areas that are intentionally flooded and managed during specific seasonal periods to enhance habitat values for specific wildlife species (CALFED Bay-Delta Program 2000). The associated ditches and drains used to manage the water level are included in this community. In Suisun Marsh (CZ 11), land management practices largely dictate natural community types. The classification as either tidal brackish emergent wetland, as described above, or as managed wetland is determined by the presence of a levee or dike and the side of the structure on which the vegetation is located. San Francisco Estuary Institute's EcoAtlas GIS dataset was used as a general guide to determine whether vegetation units in Suisun Marsh would be considered managed wetland or tidal brackish emergent wetland. This natural community is considered special-status because many of the wetland areas that are part its mosaic of habitats qualify as wetlands protected by Section 404 of the CWA, and waters of the state protected by the Porter-Cologne Act. The community is also of special interest to resource agencies responsible for managing waterfowl and shorebird populations in California.

Managed wetland is distributed throughout the study area. Substantial acreage of this type occurs in the Yolo Bypass (CZ 2), Stone Lakes NWR (CZ 4), Cosumnes River Preserve (CZ 4), and Suisun Marsh (CZ 11) (Suisun Ecological Workgroup 1997; California Department of Fish and Game 2008a; U.S. Fish and Wildlife Service 2007a). Several islands in the central Delta support large areas of this community type, including Mandeville Island, Medford Island, Holland Tract, and Bradford Island (CZ 6). The far western edge of the Delta, including Van Sickle and Chipps islands (CZ 5), and Suisun Marsh (CZ 11) also includes managed wetlands. Water at the far western border of the study area and in Suisun Marsh can be more brackish compared with other portions of the Delta where this community occurs (Suisun Ecological Workgroup 1997).

The typical hydrologic management regime includes flooding during the winter arrival of migratory birds, followed by a slow draw down to manage plant seed production and to control mosquito populations. Summer irrigation may also be conducted (U.S. Fish and Wildlife Service 2007a). The management of Suisun Marsh is unique because water salinity is a significant management issue and water use is carefully regulated (Suisun Ecological Workgroup 1997).

The managed wetland community is characterized by robust, perennial emergent vegetation and annual-dominated moist-soil grasses and forbs in freshwater areas (Hickson and Keeler-Wolf 2007) and often by pickleweed and brass buttons in brackish water areas. Vegetation that is important to waterfowl includes alkali bulrush, grand redstem, brass buttons, knotweed, barnyard grass, burhead, and swamp timothy (Suisun Ecological Workgroup 1997; U.S. Fish and Wildlife Service 2007a). During periods when water is drained from the habitat, a wide variety of annual grasses and forbs germinate and grow beneath and in the space around clumping emergent plants, such as cattails and tules.

Managed wetlands are often managed specifically as habitat for wintering waterfowl species, including northern pintail, mallard, American wigeon, green-winged teal, northern shoveler, gadwall, cinnamon teal, ruddy duck, canvasback, white-fronted goose, and Canada goose. Some wetlands are also managed for breeding waterfowl, especially mallards. They also may be managed specifically for the high diversity of shorebirds (e.g., at the Yolo Basin Wildlife Area) that also rely on wetlands in the study area for habitat during winter and long-distance migrations. Species regularly observed during these periods include western and least sandpiper, long- and short-billed dowitchers, dunlin, greater and lesser yellowlegs, whimbrel, long-billed curlew, and wilson's phalarope. Other wildlife that uses managed wetlands includes those described for tidal brackish emergent wetland (especially for managed wetland in Suisun Marsh), nontidal freshwater perennial emergent wetland, and tidal freshwater emergent wetland. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the managed wetland natural community. The community is mapped in Figure 12-1.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. Other natural seasonal wetlands are freshwater wetlands characterized by ponded or saturated soil conditions during winter and spring and by dry soil conditions throughout summer and fall until the first substantial rainfall. The vegetation of seasonal wetlands is typically composed of wetland generalist species such as hyssop loosestrife, cocklebur, dallis grass, Bermuda grass, barnyard grass, and Italian ryegrass, which typically occur in frequently disturbed sites. Some of the dominant plant species in other natural seasonal wetland are the same as those cultivated in the managed wetland community. Species dominance varies according to flooding regime.

Other natural seasonal wetlands is considered a special-status natural community because it typically qualifies as jurisdictional wetlands subject to USACE jurisdiction under Section 404 of the CWA, and wetlands subject to regulation under the Porter-Cologne Act. Wildlife species and plants associated with seasonal wetlands are discussed in the previous description of the vernal pool complex community. Table 12-2 lists the covered species supported by the other natural seasonal wetland natural community; the community is mapped in Figure 12-1.

Grassland

The grassland community is a spectrum ranging from natural to intensively managed vegetation dominated by grasses. At the more natural end of the spectrum, this natural community consists of introduced or native annual and perennial grasses and forbs (nongrass herbaceous species) (Hickson and Keeler-Wolf 2007). At the intensively managed end of the spectrum, it includes nonirrigated pasturelands (CALFED Bay-Delta Program 2000). Grasslands are often found adjacent to wetland and riparian habitats and are the dominant community on managed levees in the Delta

(Hickson and Keeler-Wolf 2007). The distribution of the grassland community in the study area is shown on Figure 12-1.

Grassland communities are generally dominated by nonnative species, such as wild oats, various bromes and barleys, Italian ryegrass, filarees, mustards, wild radish, mallows, vetches, and star-thistles. They may also support infrequent native annual and perennial grasses and forbs. In some areas of the Delta, the grassland community is interspersed with vernal pool complex, alkali seasonal wetland complex, and other natural seasonal wetland natural community types. The recent revision of *A Manual of California Vegetation* (Sawyer et al. 2009) recognizes the broad spectrum of grassland types and includes vegetation types ranging from those that are completely dominated by nonnative annual grasses to grasslands that are dominated by perennial native grasses. Within the study area, the grassland community that contains patches of other vegetation types can include alkali milk-vetch, Heckard's pepper-grass, and San Joaquin spearscale.

The grassland community designation has also been applied to areas that have been cleared of their natural vegetation cover, such as levee faces and edges of agricultural fields and roads. Vegetation in these areas is best characterized as ruderal. Ruderal vegetation is dominated by herbaceous, nonnative, plant species, some of which are considered invasive (see discussion in Section 12.1.4, *Invasive and Noxious Plant Species*). Representative species that occur in ruderal grassland areas are common mallow, bull thistle, bindweed, poison hemlock, wild lettuce, Russian thistle, and many nonnative annual grasses, including wild oats, bromes, and barleys. Ruderal vegetation on maintained levees throughout the Delta can be a persistent source of seeds of nonnative plants, some of which are considered invasive. Some native annuals, such as common spikeweed and willowherb, are also common.

Fallow fields and disturbed fields (ruderal lands) often are dense, monotypic stands of invasive ("weedy") plants that provide limited wildlife values. The range of invasive plant species in the Delta consists of herbaceous, shrub, and tree species that can occur in aquatic, wetland, and/or upland habitats. Wildlife habitat values can be affected by invasive plant species through several means, including physical alteration of habitat structure (e.g., the formation of dense stands that restrict wildlife movement, or a reduction in suitable cover and nest sites) altering food webs (e.g., reducing invertebrate prey populations), and disrupting biogeochemical processes (e.g., altering the timing of carbon availability).

Ruderal and grassland communities provide foraging, breeding, and cover habitat value for a variety of wildlife species, including gopher snake, western racer, western meadowlark, red-tailed hawk, western harvest mouse, and California vole. Wildlife communities in fallow and ruderal fields are often similar to those in cultivated row crop or silage fields. The absence of active cultivation increases the potential for successful bird nesting; however, these habitats provide limited breeding habitat for grassland-associated wildlife, such as western meadowlark, American goldfinch, and red-winged blackbird. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by grassland and cultivated lands.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community consists of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10). The historic vegetation of these largely stabilized ancient interior dunes included perennial grassland, oak woodland, and local "blowout" areas (naturally disturbed, unstable, wind-eroded and depositional sites, or river-cut sand cliffs, within stabilized dunes) that supported the distinctive dune species that survive at the Antioch Dunes NWR.

The remaining dune remnants in the Delta are highly fragmented and in many cases are dominated by nonnative weedy vegetation and trees, as opposed to the characteristic native vegetation of interior dune remnants at Antioch Dunes NWR. Stabilized sand dunes are found on Brannan Island, south of Dutch Slough (CZ 5), and in other small areas throughout the study area. Plant communities found on dune soils typically are dominated by ripgut brome, yellow star-thistle, telegraph weed, wild lettuce, wild radish, beach suncup, and yarrow, with occasional shrubs such as deerweed, nude buckwheat, Chamisso's lupine, and silver bush lupine.

Inland dune scrub is considered a special-status natural community because it provides suitable habitat for Antioch Dunes evening primrose and Contra Costa wallflower, which are federally and state listed as endangered. Because of their limited distribution, the presence of sensitive species, and their declining geographic extent, dunes are also tracked by CDFW.

Rare invertebrates have been collected at the isolated dune habitat at Antioch Dunes NWR since the 1930s. Wildlife species associated with this habitat include mammals, such as Botta's pocket gopher, California ground squirrel, Townsend's mole, and black-tailed jackrabbit; reptiles, such as western racer, side-blotched lizard, and western fence lizard; and various resident and migratory bird species. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by the inland dune scrub natural community. The community is mapped in Figure 12-1.

Cultivated Lands

Cultivated lands is the predominant land cover type in the study area. These lands have been subdivided into two broad types – cropland and non-cropland – to better understand the relationship between cultivated lands and the species analyzed in this chapter. Cropland includes the major crops and cover types in agricultural production, including small grains (wheat and barley), field crops (corn, sorghum, and safflower), truck crops (tomatoes and sugar beets), forage crops (hay and alfalfa), irrigated pastures, orchards, and vineyards. Non-cropland includes agricultural areas used for farmsteads, livestock feedlots, dairies, poultry farms, and small roads, ditches and nonplanted areas associated with cultivated lands.

The distribution of seasonal crops varies annually within the study area, depending on crop-rotation patterns and market forces. A more detailed description of the distribution of crop types is provided in Chapter 14, *Agricultural Resources*. General cropping practices result in monotypic stands of vegetation for the growing season and bare ground in fall and winter. Regular maintenance of fallow fields, roads, ditches, and levee slopes, can reduce the establishment of ruderal vegetation or native plant communities. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by cultivated lands. These lands are mapped in Figure 12-1. Some of the principal crop types and their value to wildlife are discussed below.

Alfalfa

Alfalfa is an irrigated, intensively mowed, leguminous crop that constitutes a dynamic habitat. Vegetation structure varies with the growing, harvesting, and fallowing cycles. Alfalfa is rotated periodically with other crops, such as vegetables and cereal grains. It is a very productive crop that does not require frequent tilling, so it can support large populations of small mammals (e.g., voles) and invertebrate species. As a result, it provides high-value foraging habitat for wildlife, including wading birds, shorebirds, blackbirds, and hawks. Some of these species, such as shorebirds, use the fields when they are periodically flood irrigated. Alfalfa can be particularly important to Swainson's hawk, white-tailed kite, and other raptor species, which capitalize on high prey densities and cycles of increased prey availability when the fields are being irrigated and mowed.

Irrigated Pasture

Irrigated pastures are managed grasslands that are not typically tilled or disturbed frequently. They are usually managed with a low structure of native herbaceous plants, cultivated species, or a mixture of both. Irrigated pastures provide breeding opportunities for ground-nesting birds and burrowing animals, such as burrowing owl, western meadowlark, California ground squirrel, and Botta's pocket gopher. The open structure of irrigated pastures provides foraging habitat for grassland-foraging wildlife, such as red-tailed hawk, northern harrier, American kestrel, and coyote.

Rice

Rice is a flood-irrigated crop of seed-producing annual grasses. It is maintained in a flooded state until near maturation. Rice is usually grown in areas that previously supported natural wetlands, and many wetland wildlife species use rice fields, especially waterfowl and shorebirds. Waste grain also provides food for species such as ring-necked pheasant and sandhill crane. Other wildlife that use rice fields include giant garter snake, bullfrog, and wading birds that forage on aquatic invertebrates and small vertebrates, such as crayfish and small fishes. Rice fields provide habitat for a range of wintering waterfowl species in the Yolo Bypass. In particular, the practice of flooding rice fields in winter to allow rice stubble to rot, instead of burning rice stubble in the fall, provides a wide variety of ducks and geese an opportunity to loaf or forage in rice fields in winter and important foraging habitat for shorebirds. Fallow rice fields also provide important habitat for geese, cranes, large herons and egrets and can also provide breeding habitat for waterfowl such as mallards and gadwall.

Other Cultivated Crops

Other cultivated crops include grain and seed crops, as well as row crops and silage. Grain and seed crops are annual grasses that are grown in dense stands and include corn, wheat and barley, and others. Because the dense growth makes it difficult to move through these fields, most of the wildlife values are derived during the early growing period, and especially following the harvest, when waste grain is accessible to waterfowl and other birds, such as sandhill cranes. In some areas of the Delta, grain fields support a substantial proportion of the sandhill crane population that winters in California.

Although generally of lesser value to wildlife than native habitats, row crop and silage fields often support abundant populations of small mammals, such as western harvest mouse and California vole. These species in turn attract predators such as gopher snake, western racer, American kestrel, and red-tailed hawk. Other reptile and bird species prey on the insect populations abundant in row crop and silage fields, including western fence lizard, Brewer's blackbird, American crow, and the nonnative European starling.

Orchards

Orchards are habitats dominated by a single tree species. Trees are usually kept fairly low and bushy, with a mostly closed canopy and an open understory. Orchards usually are grown on fertile land that formerly supported diverse and productive natural habitats and wildlife. Orchard habitats are used by several common woodland-associated species, such as western gray squirrel, American robin, red-tailed hawk, bats, and the nonnative black rat. The western red bat (a state species of special concern, see Special-Status Species below) is known to roost in orchards which may serve as an alternative habitat to the species' more preferred habitat of large cottonwoods, sycamores, and oaks (Pierson et al. 2006)

Vineyards

Vineyards are single-species vines grown in rows on trellises. Rows are normally formed by intertwining vines, with open spaces between the rows, and movement between rows is restricted. The spaces between rows either are barren soil or are composed of a cover crop of natural or domesticated herbaceous plants. Vineyards are usually grown on fertile land that formerly supported diverse and productive natural habitats and wildlife. Except for some common species, such as mourning dove, and raptors that use perches and nest boxes installed to attract raptors to control pest species, vineyards provide little wildlife habitat.

Developed Lands

Additional lands in the study area that were not designated with a natural community type are characterized here as developed lands. Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities. Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. Dense urban areas support less wildlife than less dense suburban settings support. Suburban areas with mature trees (ornamental or native) can approximate a natural environment and more native species may occur than in other urban settings. Bird species include house sparrow, house finch, western scrub-jay, and European starling in more urban zones, progressing to wrentit, bushtit, white-tailed kite, red-tailed hawk, red-shouldered hawk, and California quail in more suburban environments.

Mammal species in urban residential areas include raccoon, opossum, and striped skunk, with black-tailed deer and black-tailed jackrabbit in more suburban settings. California slender salamander, gopher snake, and western fence lizard could also be present in these areas. Riprap on levees provides potential upland habitat for a number of aquatic wildlife species, including the federally and state-listed giant garter snake (see BDCP Appendix 2.A, Section 2A.28.2, and the following section for more species information). Riprap on levees provides a thermal gradient, warm surfaces and cooler underground refuges, similar to burrows adjacent to aquatic habitats in locations where burrows may be limiting. Riprap is included in a GIS data layer in the habitat modeling completed for the BDCP.

12.1.3 Special-Status Species

This section addresses plant and wildlife species selected for coverage under the BDCP and other special-status species that have a potential to occur in the study area or to be adversely affected by the BDCP but that did not meet the BDCP screening criteria for covered species.

As described in BDCP Appendix 1.A, *Evaluation of Species Considered for Coverage*, the BDCP planning process included an evaluation of 234 special-status species for coverage under the BDCP. Species considered for BDCP coverage were limited to special-status species that were known or believed to occur near the Plan Area. All such species met one or more of the following criteria.

- Are listed as threatened or endangered under ESA.
- Are proposed or candidates for listing under ESA.
- Are listed as threatened or endangered under CESA.
- Are candidates for listing under CESA.
- Are California species of special concern.
- Are California fully protected species.
- Are USFWS birds of conservation concern.
- Are National Marine Fisheries Service (NMFS) species of concern.
- Are plants listed as rare under the California Native Plant Protection Act (NPPA).
- Are plants with a California Rare Plant Rank (CRPR) of 1A, 1B, or 2.

The BDCP evaluation process used four criteria to determine which special-status species were proposed for coverage under the BDCP.

- Listing status of the species.
- Likelihood that the species is present in the Plan Area or other areas within the geographic scope.
- Potential for the species to be adversely affected by BDCP covered activities, including the implementation of conservation measures.
- Information available to determine effects on species and to identify effective conservation measures.

Species that met all four criteria were proposed for coverage under the BDCP, as described in BDCP Appendix 1.A. These covered species are listed in Table 12-2 and are analyzed in this EIR/EIS. Table 12-2 also identifies the BDCP natural communities and land cover types that these species are associated with. More detailed descriptions of the habitat models used for the covered species can be found in BDCP Appendix 2.A, *Covered Species Accounts*. The location of the impact discussions for each of these species can be tracked by the impact numbers listed in the table. Impacts are numbered sequentially under each alternative discussion in Section 12.3, *Environmental Consequences*.

A similar but slightly expanded set of criteria was used for identifying other special-status species that did not meet the criteria for inclusion in the BDCP but that do warrant inclusion this EIR/EIS. In the EIR/EIS, special-status species are legally protected or otherwise considered sensitive by federal, state, or local resource agencies. Special-status species are species, subspecies, or varieties that fall into one or more of these categories.

- Are listed as threatened or endangered under ESA.
- Are proposed or candidates for listing under ESA.
- Are listed as threatened or endangered under CESA.
- Are plants listed as rare under the NPPA.
- Are candidates for listing under CESA.

- Are taxa (i.e., taxonomic categories or groups) that meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the State CEQA Guidelines (e.g., species that appear on the CDFW special animals list).
- Are California species of special concern.
- Are California fully protected species.
- Are species identified on the Western Bat Working Group list (1998).
- Are plants ranked as "rare, threatened, or endangered in California" (CRPR 1B and 2).
- Are plants that may warrant consideration on the basis of local significance or recent biological information (CEQA Guidelines Section 15380[d]), which may include some CRPR 3 and 4 species (plants about which more information is needed to determine their status and plants of limited distribution).
- Some plant species included on the CNDDB *Special Plants, Bryophytes, and Lichens List* (current list available: http://www.dfg.ca.gov/biogeodata).
- Are plants considered to be locally significant species, that is, species that are not rare from a statewide perspective but are rare or unique in a local context, such as within a county or region (CEQA Section15125 [c]) or are so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G).

Table 12-3 provides a list of noncovered special-status species that are addressed in this EIR/EIS. Table 12-3 also identifies the BDCP natural communities and land cover types that these species are associated with. More detailed descriptions of the habitat models developed by ICF and used for the noncovered species analysis can be found below in Sections 12.1.3.2 and 12.1.3.3. The location of the impact discussions for each of these species can be tracked by the impact numbers listed in the table. Impacts are numbered sequentially under each alternative discussion in Section 12.3, *Environmenal Consequences*.

Table 12-2. Covered Special-Status Species Supported by the Natural Communities, Cultivated Lands and Developed Lands of the Study Area

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Mammals															
Riparian brush rabbit *Sylvilagus bachmani riparius*	152–154				X							X			
Riparian woodrat (San Joaquin Valley) *Neotoma fuscipes riparia*	155–157				X										
Salt marsh harvest mouse *Reithrodontomys raviventris*	158, 159		X		X			X		X		X[a]			
San Joaquin kit fox *Vulpes macrotis mutica*	162, 163								X			X			X
Suisun shrew *Sorex ornatus sinuosus*	160–161		X		X			X[a]				X[a]			
Birds															
California black rail *Laterallus jamaicensis coturniculus*	57–61		X	X			X			X					
California clapper rail *Rallus longirostris obsoletus*	62–65		X	X											
Greater sandhill crane *Grus canadensis tabida*	69–71							X	X	X	X	X			X
Least Bell's vireo *Vireo bellii pusillus*	75–79				X										
Suisun song sparrow *Melospiza melodia maxillaris*	80–82		X	X						X					
Swainson's hawk *Buteo swainsoni*	83–86				X			X	X	X	X	X			X
Tricolored blackbird *Agelaius tricolor*	87–90		X	X	X		X	X	X	X	X	X			X
Western burrowing owl *Athene cunicularia hypugaea*	91–94							X	X	X	X	X			X

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	95–99				X										
White-tailed kite *Elanus leucurus*	100–103				X			X	X	X	X	X			X
Yellow-breasted chat *Icteria viriens*	104–108				X										
Reptiles															
Giant garter snake *Thamnophis gigas*	49–51	X		X	X	X	X	X	X	X	X	X	X	X[b]	X
Western pond turtle *Actinemys marmorata*	52–54	X	X	X	X	X	X	X	X	X	X	X			X
Amphibians															
California red-legged frog *Rana draytonii*	44, 45			X	X	X	X	X	X	X	X	X			X
California tiger salamander (Central Valley distinct population segment [DPS]) *Ambystoma californiense*	46–48							X	X		X	X			
Invertebrates															
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	35–37				X				X[c]			X[c]			
California linderiella *Linderiella occidentalis*	32–34							X	X						
Conservancy fairy shrimp *Branchinecta conservatio*	32–34							X	X						
Longhorn fairy shrimp *Branchinecta longiantenna*	32–34							X	X						
Midvalley fairy shrimp *Branchinecta mesovallensis*	32–34							X	X						
Vernal pool fairy shrimp *Branchinecta lynchi*	32–34							X	X						

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Vernal pool tadpole shrimp *Lepidurus packardi*	32–34							X	X						
Plants															
Alkali milk-vetch *Astragalus tener* var. *tener*	169							X	X			X			
Boggs Lake hedge-hyssop *Gratiola heterosepala*	169								X						
Brittlescale *Atriplex depressa*	170							X	X						
Carquinez goldenbush *Isocoma arguta*	171											X			
Delta button celery *Eryngium racemosum*	170, 172				X			X	X						
Delta mudwort *Limosella australis*	173		X	X	X										
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	173		X	X	X										
Dwarf downingia *pusilla*	169								X						
Heartscale *Atriplex cordulata*	170							X	X			X			
Heckard's peppergrass *Lepidium latipes* var. *heckardii*	169, 170							X	X						
Legenere *Legenere limosa*	169								X						
Mason's lilaeopsis *Lilaeopsis masonii*	173		X	X	X										
San Joaquin spearscale *Atriplex joaquiniana*	170							X	X						
Side-flowering skullcap *Scutellaria lateriflora*	173			X	X						X				

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Slough thistle *Cirsium crassicaule*	172				X		X								
Soft bird's-beak *Chloropyron molle* subsp. *molle*	173		X												
Suisun Marsh aster *Symphyotrichum lentum*	173		X	X	X										
Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*	173		X												

Natural community codes:
TPA = tidal perennial aquatic.
TBEW = tidal brackish emergent wetland.
TFEW = tidal freshwater emergent wetland.
VFR = valley/foothill riparian.
NPA = nontidal perennial aquatic.
NFPEW = nontidal freshwater perennial emergent wetland.
ASWC = alkali seasonal wetland complex.
VPC = vernal pool complex.
MW = managed wetland.
ONSW = other natural seasonal wetland.
G = grassland (also includes the subcategory of degraded vernal pool complex).
IDS = inland dune scrub.

[a] These communities are identified as secondary habitats within 150 feet of primary habitat in the BDCP species model.
[b] Riprap along Plan Area waterways is considered developed land and is included in the habitat modeling for giant garter snake.
[c] Vernal pool complex and grasslands within 200 feet of streams are considered potential habitat for this species in the BDCP model.

Table 12-3. Noncovered Special-Status Species Supported by the Natural Communities, Cultivated Lands and Developed Lands of the Study Area

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Invertebrates															
Antioch Adrenid Bee *Perdita scitula antiochensis*	–												X		
Antioch Dunes Anthicid Beetle *Anthicus antiochensis*	41				X								X		
Antioch Dunes halictid bee *Sphecodogastra antiochensis*	–												X		
Antioch Efferian Robberfly *Efferia antiochi*	–												X		
Antioch Mutillid Wasp *Myrmosula pacifica*	–												X		
Antioch Sphecid Wasp *Philanthus nasalis*	–												X		
Blennosperma Vernal Pool Andrenid Bee *Andrena blennospermatis*	38–40							X	X						
Callippe Silverspot Butterfly *Speyeria callippe*	43											X			
Curved-foot Hygrotus Diving Beetle *Hygrotus curvipes*	38–40							X	X						
Delta Green Ground Beetle *Elaphrus viridis*	42								X			X			
Hairy Water Flea *Dumontia oregonensis*	38–40							X	X						
Hurd's Metapogon Robberfly *Metapogon hurdi*	–												X		
Lange's Metalmark Butterfly *Apodemia mormo langei*	–												X		
Middlekauff's Shieldback Katydid *Idiostatus middlekauffi*	–												X		
Molestan Blister Beetle *Lytta molesta*	38–40								X			X			

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Redheaded Sphecid Wasp *Eucerceris ruficeps*	–												X		
Ricksecker's Water Scavenger Beetle *Hydrochara rickseckeri*	38–40							X	X						
Sacramento Anthicid Beetle *Anthicus sacramento*	41				X								X		
Reptiles															
Blainville's horned lizard *Phrynosoma blainvillii*	55, 56											X	X		
San Joaquin coachwhip *Coluber flagellum ruddocki*	55, 56							X	X			X			
Silvery legless lizard *Anniella pulchra pulchra*	55, 56												X		
Birds															
Bank swallow *Riparia riparia*	146, 147				X										
Black crowned night heron *Nycticorax nycticorax*	117–120				X										
Black tern *Chlidonias niger*	129a–129c														X
California horned lark *Eremophila alpestris actia*	130–133							X	X			X			X
California least tern *Sternula antillarum browni*	66–68	X													
Cooper's hawk *Accipiter cooperii*	109–112				X										
Double-crested cormorant *Phalacrocorax auritus*	117–120				X										
Ferruginous hawk *Buteo regalis*	113–116							X	X			X			X
Golden eagle *Aquila chrysaetos*	113–116							X	X			X			X
Grasshopper sparrow *Ammodramus savannarum*	130–133							X	X			X			X

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Great blue heron *Ardea herodias*	117–120				X										
Great egret *Ardea alba*	117–120				X										
Least bittern Ixobrychus exilis	134–137			X			X			X	X				
Lesser sandhill crane *Grus canadensis canadensis*	72–74							X	X	X	X	X			X
Loggerhead shrike *Lanius ludovicianus*	138–141							X	X			X			X
Mountain plover *Charadrius montanus*	125–128							X	X			X			X
Northern harrier *Circus cyaneus*	121–124		X	X			X	X	X	X	X	X			X
Osprey *Pandion haliaetus*	119–112				X										
Redhead *Aythya americana*	178–183						X			X					
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	80–82		X	X						X					
Short-eared owl *Asio flammeus*	121–124		X	X			X	X	X	X	X	X			X
Snowy egret *Egretta thula*	117–120				X										
Song sparrow "Modesto" population *Melospiza melodia*	142–145			X	X		X			X	X				
Tule greater white-fronted goose *Anser albifrons*	178–183						X			X					
White-faced ibis *Plegadis chihi*	134–137			X			X			X	X				
Yellow warbler *Setophaga petechia*	75–79				X										
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	148–151			X			X	X	X	X	X	X			X

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Mammals															
American Badger *Taxidea taxus*	162, 163							X	X			X			
Big brown bat *Eptesicus fuscus*	166–168	X	X	X	X	X	X	X	X	X	X	X	X	X	X
California myotis *Myotis californicus*	166–168	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Canyon bat *Parastrellus hesperus*	166–168											X	X		
Hoary bat *Lasiurus cinerus*	166–168	X	X	X	X	X	X	X	X	X	X	X		X	X
Little brown myotis *Myotis lucifugus*	166–168	X	X	X	X	X	X	X	X	X	X	X			X
Mexican free-tailed bat *Tadarida brasiliensis*	166–168	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pallid bat *Antrozus pallidus*	166–168											X	X	X	X
San Joaquin pocket mouse *Perognathus inornatus inornatus*	164, 165											X			
Silver-haired bat (migration only) *Lasionycteis noctivagans*	166–168				X	X	X	X	X	X	X	X	X	X	X
Townsend's big-eared bat *Corynorhinus townsendii*	166–168	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Western mastiff bat *Eumops perotis*	166–168								X			X	X	X	X
Western red bat *Lasiurus blossevillii*	166–168				X	X	X					X			X
Western small-footed myotis *Myotis cilioabrum*	166–168	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yuma myotis *Myotis yumanensis*	166–168	X	X	X	X	X	X	X	X	X	X	X		X	X

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Plants															
Ferris's milk vetch *Astragalus tener* var. *ferrisiae*	169							X	X						
Crownscale *Atriplex coronata* var. *coronata*	170							X	X						
Vernal pool smallscale *Atriplex persistens*	169								X						
Big tarplant *Blepharizonia plumosa*	171											X			
Watershield *Brasenia schreberi*	175					X	X								
Round-leaved filaree *California macrophylla*	171											X			
Bristly sedge *Carex comosa*	175						X								
Pappose tarplant *Centromadia parryi* subsp. *parryi*	171							X				X			
Parry's rough tarplant *Centromadia parryi* subsp. *rudis*	171							X	X			X			
Palmate-bracted bird's-beak *Chloropyron palmatum*	170							X	X						
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	173		X	X											
Small-flowered morning-glory *Convolvulus simulans*	171											X			
Hoover's cryptantha *Cryptantha hooveri*	174											X	X		
Recurved larkspur *Delphinium recurvatum*	170							X				X			
Streamside daisy *Erigeron bioletti*	171											X			
Antioch Dunes buckwheat *Eriogonum nudum* var. *psychicola*	174												X		
Mt. Diablo buckwheat *Eriogonum truncatum*	174											X			

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	174												X		
Diamond-petaled California poppy *Eschscholzia rhombipetala*	171											X			
Stinkbells *Fritillaria agrestis*	171											X			
Fragrant fritillary *Fritillaria liliacea*	171											X			
Hogwallow starfish *Hesperevax caulescens*	169								X			X			
Woolly rose-mallow *Hibiscus lasiocarpus* subsp. *occidentalis*	175			X	X		X								
Northern California black walnut *Juglans hindsii*	172				X										
Contra Costa goldfields *Lasthenia conjugens*	169								X						
Ferris' goldfields *Lasthenia ferrisiae*	169							X	X						
Cotulaleaf navarretia *Navarretia cotulifolia*	169							X	X			X			
Baker's navarretia *Navarretia leucocephala* subsp. *bakeri*	169								X						
Colusa grass *Neostapfia colusana*	169								X						
Antioch Dunes evening-primrose *Oenothera deltoides* subsp. *howellii*	174												X		
Gairdner's yampah *Perideridia gairdneri* ssp. *gairdneri*	171											X			
Bearded popcorn-flower *Plagiobothrys hystriculus*	169								X						
Eel grass pondweed *Potamogeton zosteriformis*	175					X	X								
Delta woolly marbles *Psilocarphus brevissimus* var. *multiflorus*	169								X						

Common Name *Scientific Name*	Impact Number(s)	Natural Communities												Developed Lands	Cultivated Lands
		TPA	TBEW	TFEW	VFR	NPA	NFPEW	ASWC	VPC	MW	ONSW	G	IDS		
Sanford's arrowhead *Sagittaria sanfordii*	175			X		X	X								
Marsh skullcap *Scutellaria galericulata*	175			X	X		X								
Keck's checkerbloom *Sidalcea keckii*	171											X			
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	172				X		X								
Saline clover *Trifolium hydrophilum*	169		X					X	X						
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	171							X				X			
Solano grass *Tuctoria mucronata*	169								X						

Natural community codes:

TPA = tidal perennial aquatic.
TBEW = tidal brackish emergent wetland.
TFEW = tidal freshwater emergent wetland.
VFR = valley/foothill riparian.
NPA = nontidal perennial aquatic.
NFPEW = nontidal freshwater perennial emergent wetland.
ASWC = alkali seasonal wetland complex.
VPC = vernal pool complex.
MW = managed wetland.
ONSW = other natural seasonal wetland
G = grassland.
IDS = inland dune scrub.

12.1.3.1 Critical Habitat

Critical habitat refers to areas designated by the USFWS for the conservation of species listed as threatened or endangered under the ESA. When a species is proposed for listing under the ESA, the USFWS considers whether there are certain areas essential to the conservation of the species.

Critical habitat is defined in Section 3 of the ESA as follows.

1. The specific areas within the geographical area occupied by a species at the time it is listed in accordance with the Act, on which are found those physical or biological features:
    a. essential to the conservation of the species, and
    b. that may require special management considerations or protection; and
2. Specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Any federally action (permit, license, or funding) in critical habitat requires that federal agency to consult with the USFWS where the action has potential to adversely modify the habitat for the species.

The federally listed wildlife and plant species that have designated critical habitat within the study area are presented in Table 12-4 below. Critical habitat for each species is presented in the figures referenced in the species discussions in Sections 12.1.3.3 and 12.1.3.4.

Table 12-4. Designated Critical Habitat within the Study Area for Wildlife and Plant Species

Species	Acres of Critical Habitat
Vernal pool tadpole shrimp	9,579
Conservancy fairy shrimp	3,340
Vernal pool fairy shrimp	11,090
Delta green ground beetle	321
California tiger salamander, Central California DPS	1,780
California red-legged frog	3,321
Suisun thistle	2,034
Soft bird's-beak	1,706
Contra Costa wallflower	305
Antioch Dunes evening primrose	305
Contra Costa goldfields	5,138
Solano grass	0.4
Colusa grass	0.4

12.1.3.2 Special-Status Wildlife Species

Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*, provides information on the 116 special-status wildlife species that were identified for consideration in the EIR/EIS, including common and scientific name, listing status (federal, state, global rank, and/or state rank), notes on the species habitat, distribution in California, and potential for occurrence in the study area. The species listed in this table were generated from queries of the CNDDB and the USFWS for the counties within the study area. Twenty-eight of these species are covered species in the BDCP and 88 are noncovered species addressed in this EIR/EIS.

The following summaries provide information on the species' habitat requirements, distribution, and occurrences within the study area. The habitat and distribution information for covered species is largely based on the species account information found in BDCP Appendix 2.A, *Covered Species Accounts.* The habitat models for noncovered species described below were based on one or more of the following characteristics: species range; natural communities in which the species are found; specific vegetation alliances within each natural community; and occurrence records. In cases where covered and noncovered species have the same habitat requirements (e.g., the covered least Bell's vireo and the noncovered yellow warbler), modeled habitat for the covered species was applied to the noncovered species. For a few species that have specific habitat elements that are at a smaller scale than the minimum mapping units used in the BDCP vegetation/land cover dataset (e.g., sand bar habitat for anthicid beetles) the extent of habitat was qualitatively evaluated. Species occurrence data were obtained from the CNDDB and from field surveys conducted in support of the Delta Habitat Conservation and Conveyance Program (DHCCP) (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Additional occurrence records were obtained from a number of species experts (Hansen, Ivey, pers. comm.) which are maintained in a DHCCP GIS data set.

The following summaries include species account information found in BDCP Appendix 2.A *Covered Species Accounts*, except where otherwise cited.

Vernal Pool Crustaceans

California Linderiella

California linderiella, which has a NatureServe conservation status of vulnerable and a state conservation status of imperiled to vulnerable, occurs in a variety of vernal pools and other seasonal wetlands in the Central Valley and central coastal California. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands in CZ 8 provide potential California linderiella habitat in the study area (Figure 12-5). There are 382 occurrences of California linderiella throughout the state, including 13 in the study area (California Department of Fish and Wildlife 2013). The study area includes portions of the Jepson Prairie core recovery area, which was developed in part for the conservation of California linderiella.

Conservancy Fairy Shrimp

Conservancy fairy shrimp, a federally listed endangered species, occurs in large turbid vernal pools from Butte and Tehama Counties south to Ventura County. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands in CZ 8 provide potential Conservancy fairy shrimp habitat in the study area (Figure 12-5). There are 34 known occurrences of Conservancy fairy shrimp range-wide, six of which are in the study area (California Department of Fish and Wildlife 2013). The study area includes a portion of Jepson Prairie, which is a core recovery area for Conservancy fairy shrimp and supports three of these occurrences. The Collinsville core recovery area, which was developed in part for Conservancy fairy shrimp, also lies within the study area on the western edge of the Montezuma Hills but has no documented occurrences. In addition, the study area contains critical habitat for Conservancy fairy shrimp between Potrero Hills and the northern limits of the study area, near Suisun Marsh.

Longhorn Fairy Shrimp

Longhorn fairy shrimp, a federally listed endangered species, is typically found in small pools of relatively short ponding duration and in pools with alkali soils in scattered locations from Alameda to San Luis Obispo Counties. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands in CZ 8 provide potential longhorn fairy shrimp habitat. There are no records of longhorn fairy shrimp in the study area, although there are occurrences southwest of the study area in the Byron Hills area (Figure 12-5) (California Department of Fish and Wildlife 2013). This area is part of the Altamont Hills core recovery area, which was developed in part for the recovery of longhorn fairy shrimp. A portion of this recovery area lies within the study area, just west of Clifton Court Forebay. This general area represents the most suitable habitat for the species in the study area. This species is very rare, with only 10 recorded occurrences throughout the state.

Midvalley Fairy Shrimp

Midvalley fairy shrimp, which has a NatureServe conservation status of imperiled, occurs in vernal pools and other seasonal wetlands in the Central Valley from Sacramento County to Fresno County. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands in CZ 8 provide potential midvalley fairy shrimp habitat in the study area (Figure 12-5). There are 99 CNDDB species occurrences throughout the state, including seven CNDDB occurrences in the study area and one DHCCP occurrence (California Department of Fish and Wildlife 2013, Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The study area contains a portion of the Altamont Hill core recovery area, which was developed in part for the conservation of midvalley fairy shrimp.

Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp, a federally listed threatened species, occurs in vernal pools and other seasonal wetlands (including ditches) in the Central Valley from Shasta County to Tulare County and in the central and southern Coast Ranges from Solano County to Ventura County. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands CZ 8 provide potential vernal pool fairy shrimp habitat in the study area. There are 608 recorded occurrences throughout the state (California Department of Fish and Wildlife 2013; Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), including 18 in the study area (Figure 12-5). Some locations have multiple records from recent DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The study area covers portions of the Altamont Hills and Jepson Prairie core recovery areas, which were developed in part for the recovery of vernal pool fairy shrimp. The study area also includes critical habitat for vernal pool fairy shrimp from the Potrero Hills to the northern limits of the study area near Suisun Marsh, and in an area just west of Clifton Court Forebay.

Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp, which is listed as endangered under ESA, occurs in a variety of vernal pool and seasonal wetlands, typically those that pool into late spring, from Shasta County to Tulare County in the Central Valley and foothills, and in portions of the Bay Area in Alameda and Contra

Costa Counties. According to the BDCP habitat model for this species, vernal pool complexes and alkali seasonal wetlands in CZ 8) provide potential vernal pool tadpole shrimp habitat in the study area (Figure 12-5). There are 274 species occurrences throughout the state, including 16 in the study area (California Department of Fish and Wildlife 2013). The study area covers portions of the Collinsville and Jepson Prairie core recovery areas, which were developed in part for the recovery of vernal pool tadpole shrimp. The study area also includes critical habitat for vernal pool tadpole shrimp from the Potrero Hills to the northern limits of the study area near Suisun Marsh.

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle's life cycle is dependent on elderberry shrubs (its host plant) that are adjacent to, or contiguous with, riparian forests, floodplains, or relict elderberry savannas. The species, which is federally listed as threatened, occurs within the Central Valley and foothills up to 3,000 feet in elevation. BDCP modeled habitat for valley elderberry longhorn beetle within the study area is composed of valley/foothill riparian, grassland within 200 feet of streams, and vernal pool complex within 200 feet of streams (Figure 12-6). There are 201 extant CNDDB records for valley elderberry longhorn beetle across its range, including three within the study area (California Department of Fish and Wildlife 2013). During surveys conducted in 2009, DWR identified several areas with elderberry shrubs along Delta channels within the proposed water conveyance facilities alignments (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). DHCCP mapped 312 locations with shrubs, mostly within the north and east Delta.

Nonlisted Vernal Pool Invertebrates

Blennosperma Vernal Pool Andrenid Bee

Blennosperma vernal pool andrenid bee, which has a NatureServe conservation status of imperiled, is a solitary, ground-nesting bee that occurs in upland areas around vernal pools where its pollen and nectar source, the vernal pool plant Blennosperma, grows (California Department of Fish and Game 2006a). This species is known to occur throughout central California. Potential habitat in the study area includes vernal pool complexes and alkali seasonal wetlands in CZ 8 (Figure 12-7). The analysis for this species utilizes the BDCP's habitat model for vernal pool crustaceans. There are 15 CNDDB records for this species across its range. One of these occurrences is located in the western most portion of CZ 1 in the Jepson Prairie area (California Department of Fish and Wildlife 2013).

Hairy Water Flea

The hairy water flea, which has a NatureServe conservation status ranging from critically imperiled to vulnerable, and a conservations status of critically imperiled in California, is a small crustacean that occurs is vernal pools and is currently known to occur only in Agate Desert near Medford, Oregon and in Sacramento and Solano Counties (NatureServe 2011a, U.S. Fish and Wildlife Service 2006). Vernal pool complexes and alkali seasonal wetlands in CZ 8 represent potential habitat for this species in the study area. The analysis for this species utilizes the BDCP's habitat model for vernal pool crustaceans. There are two CNDDB records for this species in California, neither of which is in the study area, though one occurs just to the north of CZ 11 near Travis Air Force Base (Figure 12-7) (California Department of Fish and Wildlife 2013).

Ricksecker's Water Scavenger Beetle

Ricksecker's water scavenger beetle, which has a NatureServe conservation status ranging from critically imperiled to imperiled, occurs in vernal pools and ponds in Northern California. Potential habitat for this species in the study area includes freshwater aquatic habitat (ponds), vernal pool complexes, and alkali seasonal wetlands in CZ 8 (Figure 12-7). The analysis for this species utilizes the BDCP's habitat model for vernal pool crustaceans. At the scale of the mapping used for BDCP, no freshwater ponds were mapped. There are 13 CNDDB records for this species across its range, two of which are located in the study area. One is located in the western most portion of CZ 1 in the Jepson Prairie area and the other at Cosumnes River Preserve north of I-5 in CZ 4 (California Department of Fish and Wildlife 2013).

Curved-Foot Hygrotus Diving Beetle

Curved-foot hygrotus diving beetle, which has a NatureServe conservation status of critically imperiled, occurs in vernal pools and alkali wetlands in Alameda and Contra Costa Counties (California Department of Fish and Wildlife 2013; NatureServe 2011b). Vernal pool complexes and alkali wetlands in the western portions of CZs 7, 8, and 9, and in the eastern portion of CZ 10 represent potential habitat for this species (Figure 12-7). The analysis for this species utilizes the BDCP's habitat model for vernal pool crustaceans. There are 21 CNDDB records for this species across its range. Six of them occur within western portion of the study area north and south of the city of Brentwood (California Department of Fish and Wildlife 2013).

Molestan Blister Beetle

Molestan blister beetle, which has a NatureServe conservation status of imperiled, is typically associated with flowers in dried vernal pools within central California (California Department of Fish and Game 2006b). Vernal pool complexes and alkali seasonal wetlands in CZ 8 represent potential habitat for this species in the study area (Figure 12-7). The analysis for this species utilizes the BDCP's habitat model for vernal pool crustaceans. There are 17 CNDDB records for this species across its range. One of these is within the study area and is located near the town of Brentwood in CZ 9 (California Department of Fish and Wildlife 2013).

Sacramento and Antioch Dunes Anthicid Beetles

Sacramento anthicid beetle, which has a NatureServe conservation status of critically imperiled, occurs on interior sand dunes (inland dune scrub) and sand bars, and has also been found in dredge spoil heaps (California Department of Fish and Game 2006c). The species is found in several locations along the Sacramento and San Joaquin Rivers, from Shasta to San Joaquin Counties, and at one site along the Feather River at Nicolas (California Department of Fish and Game 2006c). Suitable habitat within the study area includes the dunes at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles. There are 13 extant records of Sacramento anthicid beetle across its range, seven of which occur within the study area (Figure 12-8) (California Department of Fish and Wildlife 2013).

Antioch Dunes anthicid beetle, which also as a NatureServe conservation status of critically imperiled, occurs on interior sand dunes (inland dune scrub) and sand bars, typically areas that are unvegetated (California Department of Fish and Game 2006d). The species apparently has been extirpated from the type locality at Antioch Dunes and has more recently been documented along the Sacramento River in Glenn, Tehama, Shasta, and Solano Counties, and from one site at Nicolas on the Feather River in Sutter County (California Department of Fish and Game 2006d). Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers provide potential habitat within the study area, and possibly sandy, dredge spoil piles. There are five extant records of Antioch Dunes anthicid beetle across its range, one of which is within the study area and is just north of Rio Vista (Figure 12-9) (California Department of Fish and Wildlife 2013).

In the north Delta, three general areas were identified from a 2012 review of Google Earth imagery appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of aerial photographs in the south Delta identified sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just north of its crossing of I-5. An additional area along Paradise Cut was identified just north of I-5. These areas could be occupied by Sacramento and Antioch Dunes anthicid beetles.

Inland Dune Scrub Invertebrate Species

Although the Plan Area contains habitat for the inland dune scrub invertebrate species described in this section, BDCP actions would have no effects on inland dune scrub invertebrates. Construction and operations and maintenance of the water conveyance facilities (CM1) and other conservation measures would not affect the species' or their habitat. Therefore, the inland dune scrub invertebrate species described here are not addressed in Section 12.3, *Environmental Consequences*.

Lange's Metalmark Butterfly

A federally listed endangered species, Lange's metalmark butterfly is entirely dependent on nakedstem buckwheat as its larval host plant and as its primary adult nectar plant. This plant is restricted to sandy, well drained soils (U.S. Fish and Wildlife Service 2008). The Antioch Dunes NWR has the only known extant populations of Lange's metalmark within the study area (Figure 12-10) (U.S. Fish and Wildlife Service 2008). No other suitable habitat for this species has been identified within the study area.

Antioch Efferian Robberfly

Antioch efferian robberfly, which has a NatureServe conservation status ranging from critically imperiled to vulnerable, is known only from Contra Costa and Fresno Counties (California Department of Fish and Wildlife 2013). Little is known about the species, but it is assumed to occur in sand dunes and loose sandy soils (California Department of Fish and Game 2006e, Entomological Consulting Ltd. 2005). The inland dune scrub habitat at the Antioch Dunes NWR represents the only suitable habitat identified in the study area (Figure 12-10). There are four CNDDB records of this species in California, one of which is within the study area and is located at the Antioch Dunes NWR (California Department of Fish and Wildlife 2013).

Redheaded Sphecid Wasp

Redheaded sphecid wasp, which has a NatureServe conservation status ranging from critically imperiled to vulnerable, and ranging from critically imperiled to imperiled in California, nests in sand and is known from a few sites in the Delta and foothills of the Central Valley (Entomological Consulting Ltd. 2005; California Department of Fish and Wildlife 2013). The Antioch Dunes (the species type locality) likely represents the only suitable habitat for this species in the study area

(Figure 12-10). There are three CNDDB records of this species in California, including one within the study area at the Antioch Dunes NWR (California Department of Fish and Wildlife 2013).

Middlekauff's Shieldback Katydid

Middlekauff's shieldback katydid, which has a NatureServe conservation status ranging from critically imperiled to imperiled and a status of imperiled in California, is known only from the Antioch Dunes and is believed to have lived on various shrubs indigenous to the dunes (California Department of Fish and Wildlife 2013, Entomological Consulting Ltd 2005). The only CNDDB record for this species in California is at the Antioch Dunes (Figure 12-10) (California Department of Fish and Wildlife 2013).

Hurd's Metapogon Robberfly

Hurd's metapogon robberfly is known from only two locations, the Antioch Dunes and in Fresno County, where it is thought to be extirpated (California Department of Fish and Wildlife 2013). The species, which has a NatureServe conservation status ranging from critically imperiled to vulnerable, is believed to occur in sand dunes and loose sandy soils (Entomological Consulting Ltd. 2005). The inland dune scrub habitat at the Antioch Dunes NWR represents the only suitable habitat identified in the study area (Figure 12-10).

Antioch Mutillid Wasp

Antioch mutillid wasps usually nest in the ground in sandy soils (Entomological Consulting Ltd. 2005). This species, with a NatureServe conservation status of possibly extinct, is known from the Antioch Dunes, Yolo County and Inyo County (California Department of Fish and Wildlife 2013). The Antioch Dunes NWR is believed to represent the only habitat for this species in the study area (Figure 12-10).

Antioch Andrenid Bee

Antioch andrenid bee, which has a NatureServe conservation status of critically imperiled, occurs in interior dunes and is currently known only from the Antioch Dunes NWR (California Department of Fish and Game 2006f; California Department of Fish and Wildlife 2013). The dune habitat at Antioch Dunes NWR represents the only habitat for this species in the study area (Figure 12-10).

Antioch Sphecid Wasp

Antioch sphecid wasp, which has a NatureServe conservation status of critically imperiled, occurs in inland marine sand hills and nests in sandy ground (California Department of Fish and Game 2006g). The species was originally thought to only occur at the Antioch Dunes (where it is thought to be extirpated) but was more recently found in the Zayante sand hills of Santa Cruz County (California Department of Fish and Game 2006g; California Department of Fish and Wildlife 2013). The dune habitat at Antioch Dunes represents the only habitat for this species in the study area, though, as mentioned previously, it is believed that this population has been extirpated (Figure 12-10).

Antioch Dunes Halictid Bee

The Antioch Dunes halictid bee, which has a NatureServe conservation status of critically imperiled, occurs in sandy habitats and depends on its primary host plant, Antioch Dunes evening primrose

(Shepherd 2005). The species is known only from the Antioch Dunes, which is within the study area (Figure 12-10) (California Department of Fish and Wildlife 2013).

Delta Green Ground Beetle

Delta green ground beetle typically occurs on the margins of vernal pools and in bare areas along trails and roadsides, where individuals often hide in cracks in the mud and under low-growing vegetation (U.S. Fish and Wildlife Service 2009a). The current known range of this federally listed threatened species is in the area of Jepson Prairie, generally bound by Travis Air Force Base to the west, State Route (SR) 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007). Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area (Figure 12–11). There a six extant CNDDB records for delta green ground beetle throughout its range. One of these records occurs within the study area within Jepson Prairie along the western edge of CZ 1 (California Department of Fish and Wildlife 2013). This record is actually a compilation of several observations from 1978 to 2002 (California Department of Fish and Wildlife 2013). This general area is also critical habitat for delta green ground beetle (45 FR 52807-52810). Portions of the Jepson Prairie Core Recovery Area lie within the study area. The recovery plan calls for the protection of 100% of the delta green ground beetle occurrences and 95% of the Jepson Prairie Core Recovery Area (U.S. Fish and Wildlife Service 2005).

Callippe Silverspot Butterfly

The callippe silverspot butterfly, which is listed as endangered under ESA, is found in grassy hills surrounding San Francisco Bay that support the species' native host-plant, Johnny jump-ups. Suitable habitats are typically in areas influenced by coastal fog with hilltops available for adult congregation and mating. Preferred nectar flowers used by adults include thistles (blessed milk thistle, and coyote wildmint). Other native nectar sources include hairy false goldeneaster, coast buckwheat, mourning bride, and California buckeye. There are five extant records of callippe silverspot in the CNDDB (California Department of Fish and Wildlife 2013) for the San Bruno Mountain population in San Mateo County, and several records for a second population in the Cordelia Hills in western Solano County, part of which is in CZ 11 in the study area west of I-680 (U.S. Fish and Wildlife Service 2009b). Another area of potential habitat for the species (grassy hills with Johnny jump-ups) in the study area is Potrero Hills (Figure 12-12). Suitable habitat has been identified in this general area but the species has not been observed during surveys of portions of Potrero Hills (Solano County 2005; Arnold pers. comm.). There is no critical habitat designated for this species.

California Red-Legged Frog

The California red-legged frog is listed as threatened under ESA and is a California species of special concern. Pools in perennial and seasonal streams and stock ponds provide potential breeding habitat for this species. In addition to breeding habitat, the California red-legged frog also requires upland non-breeding habitat for cover, aestivation, and migration and other movements. Potential cover habitat consists of all aquatic, riparian, and upland areas that provide cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris; agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used (61 FR 25813). Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat (61 FR 25813). Accessibility to cover habitat is essential for the survival of red-legged frogs within a watershed and can be a factor limiting frog populations. Movement corridors may include annual grasslands, riparian corridors, woodlands, and sometimes active agricultural lands (Fellers and Kleeman 2007).

There are 26 CNDDB occurrences within the study area (California Department of Fish and Wildlife 2013) (Figure 12-13). There are also 3 non-CNNDB occurrences for this species in the study area. Most of the occurrences are west of Clifton Court Forebay (CZs 7 and 8). Three of the occurrences of California red-legged frog are west of Interstate-680 in CZ 11 and there is an additional occurrence in a small creek south of Antioch in CZ 10. There are no other reported occurrences in the study area. The study area represents the extreme eastern edge of the species' coastal range, which extends westward and southward from the study area border into the grassland foothills of eastern Contra Costa and Alameda Counties (see BDCP Appendix 2.A, *Covered Species Accounts*).

Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2.

DHCCP conducted surveys for California red-legged frog from 2009–2011 in Contra Costa County in CZ 8 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and identified one juvenile and two adult California red-legged frogs near Clifton Court Forebay. Egg masses and larvae were discovered at another location in the general vicinity of Clifton Court Forebay. In 2010, four California red-legged frogs were identified at two sites in Contra Costa County, but no evidence of reproduction was found at these sites. Larvae were found again at the site where larvae had been identified in 2009, but they were not found at four newly surveyed sites. California red-legged frog surveys were limited in 2011, with only four new parcels identified with potential aquatic habitat available. No adult or juvenile California red-legged frogs were observed or heard, and no larvae were detected during dipnetting at the surveyed locations (Appendix 12C).

California Tiger Salamander

California tiger salamander, which is listed as threatened under both ESA and CESA, is endemic to California. Approximately 80% of the species' original vernal pool habitat has been lost across its range. California tiger salamander modeled habitat is divided into aquatic habitat, which consists of vernal pools the species uses for breeding, and terrestrial cover and aestivation habitat, which consists of grasslands with burrows within 1.24 miles of breeding habitat and where California tiger salamander live most of the year.

There are 20 CNDDB records from the study area (California Department of Fish and Wildlife 2013). There is also one non-CNNDB occurrence for this species in the study area. California tiger salamander occurs within the study area in CZ 8 west of Clifton Court Forebay and in CZ 11 in the Potrero Hills (Figure 12-14). Potential habitat exists in vernal pool habitats in Yolo and Solano Counties (CZs 1, 2, and 3) west of Liberty Island and in the vicinity of Stone Lakes in Sacramento County (CZ 4). DWR found California tiger salamander west of Clifton Court Forebay in the same vicinity as several of the CNNDB (California Department of Fish and Wildlife 2013) records (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). There is also a small, isolated population near Manteca, south of Highway 120 in CZ 7.

Approximately 1,781 acres of designated critical habitat unit 2 (Jepson Prairie Unit) for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions.

Over 200 vernal pools were surveyed for amphibian species in the vicinity of Clifton Court Forebay and Stone Lakes NWR in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). No California tiger salamander eggs were found. An additional 28 vernal pools were surveyed later in the same year in Sacramento, San Joaquin, and Contra Costa Counties and no eggs were found. Three larvae were collected in 2009 at one of two sites where larval surveys were conducted in Contra Costa County. In 2010, one larva was found in the same pool as in 2009. However, no larvae were found in the other four sites surveyed. In 2011, larvae were detected at two ponds. One detection corresponded with a 2005 CNDDB record and the other possibly matched with a 1982 record. However, the 2011 surveys were limited to larval dipnetting because land access was limited (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Giant Garter Snake

The giant garter snake, which is listed as threatened under both ESA and CESA, resides in marshes, ponds, sloughs, small lakes, low-gradient streams, and other waterways, and in agricultural wetlands, including irrigation and drainage canals, rice fields, and the adjacent uplands (58 FR 54053). Habitat requirements are: (1) adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, accompanied by vegetated banks for escape cover and foraging habitat during the active season; (3) basking habitat of grassy banks and openings in waterside vegetation; and (4) higher elevation uplands for cover and refuge from flood waters during the snake's winter dormant season (Hansen and Brode 1980, Hansen 1986; U.S. Fish and Wildlife Service 2012). In some rice-growing areas, giant garter snakes have adapted well to vegetated, artificial waterways and associated rice fields (Hansen and Brode 1993). The giant garter snake resides in small mammal burrows and soil crevices located above prevailing flood elevations throughout its winter dormancy period (U.S. Fish and Wildlife Service 2012). Burrows are typically located in sunny exposures along south- and west-facing slopes. Occurrence records indicate that giant garter snakes are currently distributed in 13 unique population clusters coinciding with historical flood basins, marshes, wetlands, and tributary streams of the Central Valley (Hansen and Brode 1980; Brode and Hansen 1992; U.S. Fish and Wildlife Service 1999). These populations are isolated, without protected dispersal corridors to other adjacent populations, and are threatened by land use practices and other human activities, including development of wetland and suitable agricultural habitats. USFWS recognizes these 13 extant populations (58 FR 54053): Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin-Willow Slough, Yolo Basin-Liberty Farms, Sacramento Basin, Badger Creek-Willow Creek, Coldani Marsh, East Stockton Diverting Canal and Duck Creek, North and South Grassland, Mendota, and Burrel-Lanare. These populations extend from Fresno north to Chico and encompass 11 counties: Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties.

There are 42 CNDDB occurrences for giant garter snake in the study area in CZs 1, 2, 4, and 5 (Figure 12-15) (California Department of Fish and Wildlife 2013). There are also 9 non-CNNDB occurrences for this species in the study area (Hansen 2006, 2007, 2008, 2009). The study area includes 2 of the 13 giant garter snake subpopulations identified in the draft recovery plan for this species: the two subpopulations are in the Yolo Bypass/Willow Slough (CZ 2) and Coldani Marsh/White Slough (CZ 4) areas. Recent survey efforts suggest that extant giant garter snake populations continue to persist in these two subpopulations (Hansen 2011). While a few isolated records also occur within the Sacramento-San Joaquin Delta, surveys conducted since the mid-1980s suggest that much of the

Delta is unoccupied or supports few giant garter snakes. There have been recent sightings of giant garter snake in the vicinity of Little Connection Slough and Empire Tract, approximately 6 miles southwest of the Coldani Marsh/White Slough area (Hansen pers. comm.). These isolated records also suggest that while giant garter snakes may have occupied this region at one time, longstanding reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (Hansen 1986) and prohibited the reestablishment of viable giant garter snake breeding populations.

In 2009 DHCCP conducted surveys for giant garter snake in portions of the study area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Despite an intensive survey effort, no giant garter snake were observed or captured. Visual encounter surveys were conducted on accessible parcels with suitable habitat in 2009 concurrently with either habitat assessment reconnaissance surveys conducted in April and with trapping surveys conducted from May through September. Trapping surveys were conducted on 97 parcels where 62 individual trap lines were set for a total of approximately 42,700 trap-days. No additional trapping surveys for giant garter snake were conducted in 2010. A limited number of visual encounter surveys were conducted in spring 2010, and the species was not encountered. Following the 2009 trapping effort, giant garter snake expert Eric Hansen began independently surveying one trap location 6 weeks after one of DHCCP's traps had been removed and successfully captured more than one giant garter snake (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

In 2009 and 2010, Eric Hansen (2011) surveyed the Coldani Marsh/White Slough area. Mr. Hansen captured 27 individual giant garter snakes in the Upland Canal along the west and southwest edges of the Coldani Marsh, which is an emergent tule marsh (Figure 12-15B). Giant garter snakes were not captured or observed in any of the ponds or in any of the other emergent tidal marshes at the White Slough Wildlife Area despite the close proximity and ample connectivity amongst habitats (Hansen 2011). This might be partially due to the fact that Coldani Marsh differs from other densely vegetated perennial marsh in the area in that tidal influence is strongly muted and there is limited access for large aquatic predators such as largemouth and striped bass. Mr. Hansen noted that while he did not have access to conduct surveys, several locations near the Coldani Marsh and Upland Canal, including eastern Sycamore Slough, Dredger Cut, and Hog Slough contain promising habitat in the study area.

Western Pond Turtle

The western pond turtle is a California species of special concern primarily found in natural aquatic habitats. The species inhabits impoundments, irrigation ditches, and other artificial and natural water bodies (Ernst et al. 1994). Western pond turtle is usually found in stagnant or slow-moving freshwater habitats and sometimes in brackish habitats (Ernst et al. 1994). The western pond turtle is uncommon in high gradient streams, most likely due to low water temperatures, rapid current velocity, and few food resources (Jennings and Hayes 1994).

Historically, western pond turtles inhabited most water bodies throughout their range, but the series of warm, shallow lakes and extensive slough systems that formerly covered most of the floor of the Central Valley represented their optimal habitat (Jennings et al. 1992). Western pond turtles are common throughout many parts of the Delta, including island interiors, particularly main irrigation and drainage canals or ditches, including toe drains. The species has the potential to occur along most of the slower-moving sloughs and other natural watercourses and in artificial channels and other water bodies in the study area where essential habitat elements (streamside cover, logs and other debris for basking, and adjacent upland habitats) are present (Figure 12-16).

Upland habitats are also important to western pond turtles for nesting, overwintering, and overland dispersal (Holland 1994). Nesting sites may be 1,312 feet or more from the aquatic habitat, although usually the distance is much less and generally around 328 feet (Jennings and Hayes 1994). Dispersal habitat can be up to 1.86 miles from aquatic habitat but is typically less than 0.5 mile away. Dispersal habitat is similar to upland nesting habitat types but also includes agricultural land. Grasslands and riparian areas provide western pond turtle upland nesting and overwintering habitat.

There are 62 reported occurrences for western pond turtle throughout the study area in CZs 3–11 (California Department of Fish and Wildlife 2013). DHCCP reported incidental observations for western pond turtle during surveys for listed shrimp species and giant garter snake, but did not specify exact locations (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Silvery Legless Lizard, San Joaquin Coachwhip and Blainville's Horned Lizard

These three reptile species are California species of special concern and could occur in suitable habitat in the study area: silvery legless lizard, San Joaquin coachwhip, and Blainville's horned lizard.

The silvery legless lizard is associated with a variety of vegetation types on sandy soils with accessible moisture, primarily, but not exclusively, in semistabilized dunes. The species is distributed in patches from Antioch southward along the coast, and to the foothills, San Joaquin Valley, and southern Sierra Nevada. There are seven CNDDB occurrences in CZ 10, and a probable extinct occurrence in CZ 9 (California Department of Fish and Wildlife 2013)(Figure 12-17). The occurrences were reported from 1966 to 2005; several of these may no longer be present because of development and loss of habitat. One of the occurrences in CZ 10 is associated with inland dune habitat at the Antioch Dunes NWR and may still be extant. The remaining locations are patchy and fragmented by roads and development.

The San Joaquin coachwhip occurs in open habitats, including grasslands, savannas, open-canopy scrub, and chaparral, with available rodent burrows for cover. The species ranges across the San Joaquin Valley and associated foothills to the west and could occur in CZs 7 and 8 in upland habitat in the southern portion of the study area around Clifton Court Forebay. There are no reported occurrences in the study area. There are three occurrences within 2–5 miles of the study area west of CZs 7 and 8 (Figure 12-17) (California Department of Fish and Wildlife 2013). Coachwhips could be present in grassland and alkali seasonal wetland complex habitats in both of those CZs.

The Blainville's horned lizard is associated with a variety of open habitats, including chaparral, oak savanna, inland dunes, and grassland. The species is found primarily in areas with sandy, friable soils, scattered shrubs, and abundant ant colonies (Figure 12-17). The species' range covers most of west-central and southwestern California below 8,000 feet elevation. There are 18 occurrences within 1.3–15 miles of the study area (California Department of Fish and Wildlife 2013). The Blainville's horned lizard could occur in the stabilized dunes along the western water facilities conveyance alignment in CZ 10, in the grasslands near Clifton Court Forebay (CZ 7 and 8), and north of Stone Lake (CZ 4).

California Black Rail

California black rail, which is listed as threatened under CESA and which is a USFWS bird of conservation concern and a fully protected species under the Fish and Game Code, inhabits high elevation areas of tidal saltwater and brackish marshes and freshwater marshes in several areas of California and isolated locations in western Arizona (Eddleman et al. 1994). Approximately 80% of the California black rail subspecies resides in the San Francisco Bay (Evens et al. 1991). There are 40 CNDDB occurrences of California black rail in the study area (Figure 12-18). Most CNDDB occurrences within the study area are from Suisun Marsh in CZ 11, though several occurrences have been reported in the central study area (California Department of Fish and Wildlife 2013). DHCCP black rail breeding season surveys detected two presumed nest sites in 2009, 24 presumed nest sites in 2010 and three presumed nest sites in 2011 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The majority of presumed breeding rails were in CZ 6, but rails were also detected in CZs 4, 5, and 9. Natural communities in the study area containing suitable California black rail habitat are tidal brackish emergent wetland, tidal freshwater emergent wetland, alkali seasonal wetland complex, and managed wetland. Detailed information on California black rail can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

California Clapper Rail

California clapper rail, which is listed as endangered under both ESA and CESA and which is a fully protected species under the Fish and Game Code, is found within the tidal channels and low elevation areas of salt and brackish marshes of the San Francisco Bay Area. Its distribution within the study area is restricted to Suisun Marsh in CZ 11 (Figure 12-19). However, tidal freshwater emergent wetlands west of Highway 160, which lie within CZ 5, may provide some isolated patches of suitable habitat. There are 14 CNDDB occurrences of California clapper rail in the study area all in CZ 11 (California Department of Fish and Wildlife 2013). Detailed information on California clapper rail can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

California Least Tern

California least tern, which is listed as endangered under both ESA and CESA and which is a fully protected species under the Fish and Game Code, occurs from the San Francisco Bay Area to the tip of the Baja California peninsula. There are two CNDDB occurrences of California least tern in the study area (California Department of Fish and Wildlife 2013) (Figure 12-20). Nesting has been reported from two sites within the study area (CZ 11) in Suisun Marsh and at the Pittsburgh Generating Plant; nesting has also occurred in two other sites just outside the study area boundary. California least terns nest in loose colonies on barren or sparsely vegetated sandy or gravelly substrates above the high tide line along the coastline and in lagoons and bays of the California coast. In the San Francisco Bay Area and Suisun Bay, nesting colonies are typically located in abandoned salt ponds and along estuarine shores, often using artificially or incidentally created habitat (Rigney and Granholm 2005; Marschalek 2008). Overall, there is little to no natural nesting habitat available in the study area. While much of the tidal perennial aquatic habitat (open water) is suitable for tern foraging, current and any future nesting would be incidental and based on the availability and suitability of artificial features, such as gravel piles or unused gravel roads in the immediate vicinity of open water habitats. Suitable foraging habitat for California least tern is any tidal perennial aquatic habitat.

Greater Sandhill Crane

Greater sandhill cranes are winter residents in the study area, arriving during early September, reaching maximum densities during December and January and departing during early March. Portions of the study area are used regularly and by large numbers of greater sandhill cranes (California Department of Fish and Wildlife 2013). Greater sandhill crane is a fully protected species under the Fish and Game Code and listed as threatened under CESA. These lands make up what is designated as the greater sandhill crane use area in the greater sandhill crane habitat model (see BDCP Appendix 2.A, *Covered Species Accounts*). Sandhill cranes primarily forage in harvested row crops (primarily grains such as corn) and tend to congregate in small to large flocks. In the study area (Figure 12-21), foraging habitat consists mainly of harvested corn fields, followed by winter wheat, irrigated pastures, alfalfa fields, and fallow fields (BDCP Appendix 2.A, *Covered Species Accounts*). Mid-day loafing typically occurs in wetlands and flooded fields along agricultural field borders, levees, rice checks, and ditches, and in alfalfa fields or pastures. Night roosting is in shallowly flooded open fields and open wetlands interspersed with uplands. Sandhill cranes are sensitive to human disturbance and only occur in agricultural areas that contain suitable crops (BDCP Appendix 2.A, *Covered Species Accounts*).

Lesser Sandhill Crane

Lesser sandhill cranes do not breed in California but are winter residents and migrants in the study area, arriving during early September and reaching maximum densities during December and January and departing during early March (California Department of Fish and Wildlife 2013, Littlefield 2008). Lesser sandhill crane is a California species of special concern and large numbers of lesser sandhill cranes use portions of the study area regularly. Sandhill cranes primarily forage in row crops (primarily grains, such as corn) and tend to congregate in small to large flocks. In the study area, lesser sandhill crane foraging habitat is consistent with greater sandhill crane (although the foraging values of crop types differ between the two subspecies) and consists mainly of harvested corn fields, winter wheat, irrigated pastures, alfalfa fields, and fallow fields (Figure 12-22). Mid-day loafing typically occurs in wetlands and flooded fields along agricultural field borders, levees, rice checks, and ditches, and in alfalfa fields or pastures. Night roosting is in shallowly flooded open fields and open wetlands interspersed with uplands. Sandhill cranes (both greater and lesser) use similar roost sites and are both sensitive to human disturbance. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions. The wintering range is ten times larger than the greater sandhill crane’s and lesser sandhill crane’s average foraging flight radius from roost sites is twice that of greater sandhill cranes (Ivey pers. comm.).

Least Bell’s Vireo

Least Bell’s vireo is a state and federally endangered riparian obligate species whose potential habitat within the study area is restricted to the valley/foothill riparian natural community. The study area represents part of the center of the species’ historical range, but least Bell’s vireo has been almost entirely absent from the study area since at least the 1970s due to widespread habitat loss (Figure 12-23). There is one CNDDB occurrence of Least Bell’s vireo in the study area (California Department of Fish and Wildlife 2013). A recent sighting in April 2010 of two singing males in the Yolo Bypass Wildlife Area, and a second sighting of least Bell’s vireo in the spring of 2011 suggests the species may have the potential to re-establish within the study area. Detailed information on least Bell’s vireo can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

Yellow Warbler

Yellow warbler, California species of special concern and a USFWS bird of conservation concern, is a riparian obligate species which was once a common breeder in the Central Valley (Riparian Habitat Joint Venture 2004, Grinnell and Miller 1944). It's potential habitat within the study area is restricted to valley/foothill riparian habitats. The study area represents part of the center of the species' historical range. However, the species is largely extirpated as a breeder in the Sacramento Valley, the Delta and San Joaquin Valley because of widespread habitat loss (Riparian Habitat Joint Venture 2004). A single breeding pair was recorded in 2002 on the San Joaquin Wildlife Refuge (south of the study area) and the number of nesting territories has increased each year to 25 territories in 2011 (Dettling et al. 2012). The increase in yellow warbler territories is largely attributed to the riparian habitat restoration within the refuge. Although there are no confirmed breeding accounts, the species has been documented in the study area over the breeding season within the past 10 years (California Department of Fish and Wildlife 2013) (Figure 12-24).

Suisun Song Sparrow

Suisun song sparrow, a USFWS bird of conservation concern and a California species of special concern, is endemic to the tidal marshes of Suisun Bay. Breeding habitat consists of tidal brackish emergent wetland and tidal freshwater emergent wetland in the study area west of Sherman Island. Managed wetlands, low marsh and upland transitional zones for high tide refugia constitute secondary habitat. Within the study area, the species occupies suitable habitat in the extreme western Delta and the Suisun Marsh (Figure 12-25). There are 25 CNDDB extant occurrences of Suisun song sparrow from this portion of the study area (California Department of Fish and Wildlife 2013). The hypothetical footprint for BDCP conservation activities overlaps with nine of these occurrences, all within Suisun Marsh in areas subject to tidal habitat restoration. Detailed information on Suisun song sparrow can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

Saltmarsh Common Yellowthroat

Saltmarsh common yellowthroat is endemic to the greater San Francisco Bay region, with its eastern limits reaching to Alameda County and Suisun Bay (Gardali and Evens 2008). Breeding habitat consists of tidal brackish emergent wetland and tidal freshwater emergent wetland in the study area west of Sherman Island. Managed wetlands, low marsh and upland transitional zones for high tide refugia constitute secondary habitat. Within the study area, saltmarsh common yellowthroat occupies suitable habitat in the extreme western Delta and Suisun Marsh (Figure 12-26). The species is a USFWS bird of conservation concern and a California species of special concern. There are 17 CNDDB extant occurrences of saltmarsh common yellowthroat in the study area: 13 in CZ 11 and four in CZ 5 (California Department of Fish and Wildlife 2013). The hypothetical footprint for BDCP conservation components overlaps with five of these occurrences, all within Suisun Marsh in areas subject to tidal habitat restoration.

Swainson's Hawk

The Swainson's hawk, listed as a threatened species under CESA, is found in the study area mainly from early March through mid-September (see BDCP Appendix 2.A, *Covered Species Accounts*). It tends to nest in large trees, typically along stringers of riparian wooded vegetation, but also in roadside trees, rows or isolated trees in fields, or along field borders, small groves, farmyards, and residential rural areas (Estep 2007, 2008). Foraging takes place over the open country, historically grassland, but today Swainson's hawk forages mostly on irrigated cropland and pastureland. The

Swainson's hawk is closely associated with cultivated lands. Most of the study area consists of cultivated land and most is considered to have some value as foraging habitat for Swainson's hawk (see BDCP Appendix 2.A, *Covered Species Accounts*). However, the habitat value of crop types differ widely because of their growth and structure, which influences accessibility by foraging hawks, and because of prey abundance. There are 456 CNDDB occurrences of Swainson's hawk in the study area (Figure 12-27) (California Department of Fish and Wildlife 2013). In addition, DHCCP and other surveys have detected 306 Swainson's hawk nests in the study area. Detailed information on Swainson's hawk can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

Tricolored Blackbird

Tricolored blackbirdis candidate for listing as endangered under CESA. They are a colonial nesting passerine that are largely restricted to California. More than 95% of the California breeding population of tricolored blackbirds occurs in the Central Valley (Kyle and Kelsey 2011). There are few reported historical nesting records of tricolored blackbirds nesting in the Plan Area (Neff 1937; Beedy et al. 1991). However, more recent surveys have documented occasional nesting colonies along the fringe of Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the Plan Area (see BDCP Appendix 2.A, *Covered Species Accounts*). While breeding colonies are uncommon, the Delta is recognized as a major wintering area for the species (Hamilton 2004, Beedy 2008). Tricolored blackbirds nest colonially in large dense stands of freshwater marsh, riparian scrub, and other shrubs and herbs. Foraging habitat consists of grassland, managed wetlands, natural seasonal wetlands and diverse cultivated land cover types. Within the study area, modeled tricolored blackbird breeding and foraging habitat occur in all CZs (Figure 12-28). There are three CNDDB occurrences of tricolored blackbird in the study area; one in CZ 1 and two in CZ 7(California Department of Fish and Wildlife 2013). In addition, there are 48 occurrences from other surveys, including DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Detailed information on tricolored blackbird can be found in BDCP Appendix 2.A, *Covered Species Accounts*.

Western Burrowing Owl

The western burrowing owl is a California species of special concern and a year-round resident of the Central Valley and other portions of central California. In the study area, it is found mainly in grasslands and pasturelands west of the Sacramento River Deep Water Ship Channel in Yolo and Solano Counties, as well as along the study area's western edge from approximately Brentwood/Antioch to Tracy (Figure 12-29). Areas with greater densities of burrowing owls are mostly uncultivated, are less exposed to ground disturbances, and harbor larger and more stable populations of California ground squirrels (see BDCP Appendix 2.A, *Covered Species Accounts*). There are 144 CNDDB occurrences of western burrowing owl in the study area (California Department of Fish and Wildlife 2013). In addition, DHCCP surveys and other surveys have documented 27 occurrences of the species. All nests recorded during DHCCP surveys were in the southwest corner of the study area in alkali grassland-scrub habitat that is heavily disturbed, has extensive patches of bare ground, and has substantial ground squirrel activity. For more detail on western burrowing owl habitat requirements, see BDCP Appendix 2.A, *Covered Species Accounts.*

Western Yellow-Billed Cuckoo

Western yellow-billed cuckoo is a riparian obligate species whose habitat within the study area is restricted to valley/foothill riparian natural communities. Western yellow-billed cuckoo is proposed for listing as threatened under ESA, a USFWS bird of conservation concern, and listed as endangered under CESA. The historical distribution of western yellow-billed cuckoo extended throughout the Central Valley, but the species is now widely extirpated, with less than 1% of suitable habitat remaining in the Sacramento Valley. The remaining habitat lies between Colusa and Red Bluff. Several migrating western yellow-billed cuckoo have been spotted within the study area, but most of the suitable riparian habitat occurs in patches too small to support breeding pairs, and no confirmed recent breeding records exist. The Riparian Bird Conservation Plan (Riparian Habitat Joint Venture 2004) suggests that minimum patch size to benefit the species should be approximately 50–100 acres, with a minimum width of 100 meters. There is one CNDDB occurrence of western yellow-billed cuckoo in the study area along the Stanislaus River in the southeastern corner of the study area (California Department of Fish and Wildlife 2013)(Figure 12-30). In addition, one occurrence was detected in DHCCP surveys but nesting was not confirmed (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). For more detail on western yellow-billed cuckoo habitat requirements, see BDCP Appendix 2.A, *Covered Species Accounts.*

White-Tailed Kite

The white-tailed kite is a fully protected species under the Fish and Game Code and inhabits or uses low-elevation open grasslands, savannah-like habitats, agricultural areas, wetlands, and oak woodlands (Dunk 1995). There are seven CNDDB records of white-tailed kite nests in the study area (California Department of Fish and Wildlife 2013)(Figure 12-31). In addition, ten nests were detected during DHCCP surveys; nine in 2009 and one in 2011 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Most white-tailed kites nest in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat consisting of low-growing, herbaceous vegetation in patches of more than 1,500 square meters (Erichsen et al. 1996). Pasture and hay crops, compatible row and grain crops, and natural vegetation such as seasonal wetlands and annual grasslands provide foraging habitat for this species (Erichsen 1995). The white-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks, and therefore requires wide patches of nesting habitat where its range overlaps with the Swainson's hawk. For more detail on white-tailed kite habitat requirements, see BDCP Appendix 2.A, *Covered Species Accounts.*

Yellow-Breasted Chat

Yellow-breasted chat is a USFWS bird of conservation concern and a California species of special concern. Yellow-breasted chat nest and forage in valley/foothill riparian habitat with a thick understory shrub layer. Details of plant alliances that compose suitable yellow-breasted chat habitat are provided in BDCP Appendix 2.A, *Covered Species Accounts*. There are no CNDDB occurrences of yellow-breasted chat from the study area (California Department of Fish and Wildlife 2013)(Figure 12-32). However, field surveys for the DHCCP documented 13 occurrences in 2009 surveys, nine in 2010, and 29 in 2011 during the breeding season, although no nests were confirmed (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The National Audubon Society (2008) also noted pairs of yellow-breasted chat at Liberty Island, Sherman Island and Piper Slough in the central Delta. The hypothetical footprint for BDCP activities overlaps with one of the DHCCP (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) occurrences on the north end of Sherman Island, an area subject to tidal habitat restoration.

Cooper's Hawk and Osprey

Cooper's hawk and osprey are species on the CDFW watch list. In California, the year-round range of the Cooper's hawk includes most of the wooded portions of the state (Polite 2005). Osprey breed primarily in northern California from the Cascade Range to Lake Tahoe and south to Marin County. Their year-round range includes the northern and western portions of the Central Valley (Polite 1995). Cooper's hawk and osprey are primarily riparian tree–nesting species, although both species will also nest on man-made structures or in urban areas. Despite their high frequency of use of man-made structure for nest sites, osprey rely on fish for 99% of their diet; therefore, osprey tend to nest in close proximity to water (Poole et al. 2002). While Cooper's hawk nest in dense stands of riparian forest (Polite 2005), osprey prefer more open stands or nest platforms (Poole et al. 2002). Within the study area, suitable Cooper's hawk and osprey nesting habitat exists in all CZs and consists of valley/foothill riparian habitat with an overstory component (Figure 12-33). There are no CNDDB occurrences of Cooper's hawk or osprey nesting in the study area (California Department of Fish and Wildlife 2013. During DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), observers recorded one Cooper's hawk nesting territory in CZ 5 (although no nest was found) and three osprey nest sites at the south end of CZ 2. Two of the osprey nests were found, both on towers or poles.

Golden Eagle and Ferruginous Hawk

Golden eagle is a USFWS bird of conservation concern and is fully protected under the CDFW code. Ferruginous hawk is a USFWS bird of conservation concern. Golden eagles nest primarily on cliffs and hunt in nearby open habitats, such as grasslands, oak savannas, and open shrublands (Grinnell and Miller 1944) although trees are also used for nesting. There is limited suitable nesting habitat for golden eagles in the study area and there are no records of nesting with the exception of one CNDDB occurrence on the western border of CZ 11 (California Department of Fish and Wildlife 2013). Ferruginous hawks do not breed in California and there is no suitable nesting habitat in the study area. However, suitable foraging habitat occurs throughout the entire study area for both golden eagle and feruginous hawk. The primary foraging habitat for golden eagle and ferruginous hawk is open, dry grassland habitats (Polite and Pratt 1999, Bechard and Schmutz 1995), but also includes similar cultivated lands such as grain and hay crops, recently plowed fields, and pastures (Figure 12-34). Three CNDDB ferruginous hawk wintering occurrences have been recorded in the study area— one each in CZs 4, 8, and 11 (California Department of Fish and Wildlife 2013).

Cormorants, Herons, and Egrets

Tree-nesting waterbirds, specifically, double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron, typically use rookeries (colonial nest sites) that often include interspecies nesting with other species in this group. These species have high fidelity to nest sites and, while most species need mature, riparian trees, rookeries for black-crowned night heron have also been located in riparian scrub (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Within the study area, suitable riparian habitat for rookeries occurs primarily along or within the Delta's rivers and sloughs on mid-channel islands (Figure 12-35) (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). CNDDB records showed occurrences of rookeries for double-crested cormorant (three in CZ 4 and one in CZ 5), great blue heron (one in CZ 4 and one in CZ 5) and great egret (both in CZ 4) in the study area (California Department of Fish and Wildlife 2013). In addition, DHCCP surveys conducted in 2009, observed cormorant, heron, and egret rookeries throughout the Delta. Eight double-crested cormorant rookeries (representing more than 300 individuals) were detected throughout the Delta in riparian trees. All but one of the rookeries were located on instream islands or existing preserves. Six were adjacent to marsh, one was adjacent to grassland/scrub, and one was adjacent to alkali sink habitat. DHCCP surveyors also observed 19 great blue heron rookeries (representing more than 263 individuals) in riparian trees adjacent to sloughs, rivers, or marshes throughout the Delta. Eleven of the rookeries were on instream islands, six were adjacent to marsh complexes, and two were adjacent to grasslands/scrub habitat. Of the eight rookeries not found on instream islands, six were on preserved lands. Eleven great egret rookeries (representing at least 271 individuals) were all recorded in riparian trees throughout the Delta. Six rookeries were found in marsh complexes, three on instream islands, one along a slough in alkali sink scrub habitat, and one was in a farm complex (adjacent to an apparent marsh/slough remnant). All six rookeries adjacent to marsh were on preserved lands. Four snowy egret rookeries (representing eight individuals) were detected in the north Delta in riparian trees on preserved lands adjacent to or in marsh complexes. None were observed nesting on instream islands. Four black-crowned night heron rookeries (representing 12 herons) were also detected. Two were located in riparian scrub in the south Delta near Clifton Court Forebay. The other two were located in riparian trees north and south of Walnut Grove.

Short-Eared Owl and Northern Harrier

Short-eared owl and northern harrier are marsh-associated ground nesting birds and are both California species of special concern. In California, the short-eared owl occurs either as a resident or as a winter visitor. The breeding range is patchily distributed throughout the state, including portions of the Sacramento and San Joaquin Valleys, northeastern California, and a few scattered coastal sites (Roberson 2008). The northern harrier is a year-round resident in California and its breeding range covers northern California, the central valley, the central coast, and portions of southern deserts (Davis and Niemela 2008). Breeding and foraging habitat for short-eared owl and northern harrier in the study area includes wetland natural communities, grasslands, and grassland-like cultivated lands such as pastures and alfalfa fields (Figure 12-36). There is one CNDDB occurrence of short-eared owl in the study area, in CZ 11 (California Department of Fish and Wildlife 2013). Grizzly Island in Suisun Marsh supports the only known breeding population of short-eared owl in the study area, although small numbers have been documented episodically at the Cosumnes River Preserve and in Byron in Contra Costa County. DHCCP surveyors did not detect short-eared owl nesting in the central Delta. There are no CNDDB occurrences of northern harrier in the study area (California Department of Fish and Wildlife 2013). However, northern harrier nests were detected during DHCCP surveys (20 nests in 2009, 5 nests in 2010, and 15 nests in 2011; Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and there is suitable nesting and foraging habitat throughout the study area. No nesting northern harriers were observed in the north Delta during DHCCP surveys, although individuals were commonly observed there throughout the nesting season.

Redhead, Tule Greater White-Fronted Goose, and Cackling (Aleutian Canada) Goose

Redhead is a California species of special concern. The year-round range of redhead includes the Central Valley, northeastern California and Southern California. Suitable breeding habitat for redhead in the study area is in managed wetlands and nontidal freshwater emergent wetlands (Beedy and Deuel 2008, Granholm 2008, Figure 12-37). Redhead nests were not detected during DHCCP surveys (2009–2011), nor are there any CNDDB occurrences of breeding redhead in the study area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*; California Department of Fish and Wildlife 2013). However, small numbers of redhead nest in private duck clubs and public refuges where summer water levels are greater than 1 meter deep (Beedy and Deuel 2008). The Tule greater white-fronted goose is a California species of special concern. The nesting range is in southern Alaska, but the species winters in the Central Valley, primarily in the Sacramento, Delevan and Colusa NWRs in the Sacramento Valley, in addition to duck clubs and rice fields in the Sacramento Valley and Suisun Marsh (Duel and Takekawa 2008). Impact analysis for these species is discussed within the shorebirds and waterfowl sections, in Impacts BIO-178 through BIO-183.

Mountain Plover

The mountain plover is a California species of special concern, a USFWS bird of conservation concern and is proposed threatened under ESA. The Central Valley is one of a few key wintering areas for the Mountain Plover (Hickey et al. 2003). Suitable habitat for mountain plover includes heavily grazed grassland, short hay crops such as alfalfa, freshly tilled fields, and alkali flats (Knopf and Rupert 1995; Hunting and Edson 2008). There are two CNDDB occurrences of mountain plover in the west tail of the study area along Flannery Road and this is a traditional wintering area for the species. Suitable habitat exists in all CZs, and there are records of mountain plover outside of the study area adjacent to CZ 1 (Figure 12-38) (California Department of Fish and Wildlife 2013).

Black Tern

Black tern is a California species of special concern that historically bred in freshwater marshes and in the Central Valley. Their current breeding range overlaps with the northern tip of the study area, and suitable nesting habitat for black tern includes rice fields, flooded cultivated lands, and short emergent wetlands (Shuford 2008). Although, there are no confirmed CNDDB occurrences of breeding black tern in the study area (California Department of Fish and Wildlife 2013), the species has been documented in rice fields in the Sacramento Valley and Yolo Basin. Suitable nesting habitat for black tern in the study area consists of freshwater wetlands and rice fields in CZ 2 (Figure 12-39).

California Horned Lark and Grasshopper Sparrow

The grasshopper sparrow is a California species of special concern. The species breeding range in California is fragmented throughout the state west of the Cascade-Sierra Nevada Crest (Dobkin and Granholm 2008, Vickery 1996). The species nest in shorter, moderately grazed open grasslands but have also been recorded in grassland-like cultivated lands such as alfalfa (Unitt 2008, Grinnell and Miller 1944). In the Central Valley, loss of native and nonnative grassland through agriculture and urbanization have further fragmented grasshopper sparrow’s patchy breeding distribution (Unitt 2008).

The CNDDB reports one occurrence of grasshopper sparrow in the study area, in CZ 11 (California Department of Fish and Wildlife 2013) (Figure 12-40). In addition, five active grasshopper sparrow nests were detected during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The California horned lark is on the CDFW watch list. The year-round range of the California horned lark encompasses the majority of the state west of the Cascade-Sierra Nevada Crest (Green 2007) and it is common to abundant in open grasslands and similar habitats including alfalfa, fallow fields and pastures. Suitable breeding habitat for California horned lark exists throughout the study area, particularly in the western tail and in the alkali sink habitat in the study area’s southern portion (Figure 12-40).

Least Bittern and White-Faced Ibis

Least bittern is a California species of special concern and a USFWS bird of conservation concern. The white-faced ibis is on the CDFW watch list. There are no CNDDB occurrences of breeding least bittern or white-faced ibis in the study area (Figure 12-41) (California Department of Fish and Wildlife 2013). However, there are recent breeding season records of least bittern near Freeport (CZ 4), in the Yolo Bypass (CZ 2), and on Joice Island in Suisun Marsh (CZ 11) (Sterling 2008). In addition, there was one unconfirmed breeding least bittern occurrence in the Stone Lakes NWR during 2010 DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Breeding white-faced ibis have been recorded in the Yolo Bypass Wildlife Area (CZ 2), but are not expected to breed in the remainder of the study area (Figure 12-41). Freshwater and brackish marshes with tall emergent vegetation and managed wetlands (Sterling 2008) in the northern part of the Plan Area (limited to CZ 2, CZ 4, and CZ 11) provide suitable breeding habitat for least bittern whereas white-faced ibis breeding habitat is limited to freshwater emergent and managed wetlands (Granholm 2005).

Loggerhead Shrike

The loggerhead shrike is a California species of special concern and a USFWS bird of conservation concern. Loggerhead shrikes use a variety of open grasslands across their range, including grasslands, desert scrub, shrub-steppe, and open savannah (Yosef 1996). Loggerhead shrikes nest in shrubs and trees surrounded by open habitat. In the Central Valley, loggerhead shrikes show a positive association with grasslands, irrigated pasture, and grain and hay crops (Pandolfino and Smith 2012) but have also been detected in alkali seasonal wetland (Figure 12-42). Loggerhead shrikes in the Central Valley were shown to have neither a positive or negative association with row crops (Pandolfino and Smith 2012). However, because so little is known about the species in California, these were included as low-value habitat because they may provide foraging opportunities for loggerhead shrike. There are two CNDDB occurrences of loggerhead shrike in the study area: one in CZ 7 and one in CZ 9 (California Department of Fish and Wildlife 2013). In addition, 10–15 active loggerhead shrike nests were detected during DHCCP surveys in 2009 and 2011, respectively around the Clifton Court Forebay in CZ 8 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Song Sparrow “Modesto” Population

Song sparrow “Modesto” population (hereafter referred to as Modesto song sparrow), is ubiquitous in the Delta and nests throughout the study area. The Modesto song sparrow, a state species of special concern, was a valid subspecies until 2001 and may be again after additional taxonomic analysis (Gardali 2008). The population is endemic to the north-central portion of the Central Valley and the Bay-Delta is one of two areas with the highest population densities. There are no CNDDB records of Modesto song sparrow in the study area. However, surveyors detected more than 2,000 occurrences during DHCCP surveys in 2009, 2010, and 2011 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Little is known about the specific habitat requirements for the Modesto song sparrow (Gardali 2008). However, emergent marsh and riparian scrub provide breeding habitat (Grinnel and Miller 1944, Figure 12-43), In addition, the species has been observed to nest in valley oak riparian forests with a dense blackberry understory, vegetated irrigation canals and levees, and recently planted Valley Oak restoration sites (Gardali 2008).

Bank Swallow

The bank swallow is a threatened species under CESA. Bank swallows are a colonial-breeding migrant, arriving in California in mid-March and departing for their wintering grounds by August (California Department of Fish and Game 1992, Garrision 2004). Approximately 75% of the breeding population in California occurs along the Sacramento and Feather Rivers, upstream of the Plan Area where nesting habitat is threatened by flood control and bank protection (California Department of Fish and Game 1992). Bank swallows require fine textured sandy soils and create their burrows in vertical banks along rivers, streams, or other water. The species is dependent on bank erosion from high winter river flows to create suitable burrow substrate (Garrison 1999, Garrison 2004, Moffat et al. 2005). There are three CNDDB records of bank swallow colonies in the study area, two at the northern end of the study area in CZ 2 (one colony with an estimated 120 burrows, and one colony with an estimated 20 burrows), and one on Brannan-Andrus Island in CZ 5 with unknown colony size (California Department of Fish and Wildlife 2013). DHCCP surveys for bank swallow were conducted in selected areas within the Plan Area during 2008, but suitable habitat for bank swallow was not encountered and no bank swallows were detected (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). There is little to no other nesting habitat available in the study area (Figure 12-44). The majority of potential habitat for bank swallow in the study area is covered in rip rap for bank stabilization, or is made of unsuitable substrate for bank swallow colonies to form.

Yellow-Headed Blackbird

Yellow-headed blackbird is a California species of special concern. Within the study area, suitable yellow-headed blackbird breeding habitat includes freshwater emergent wetlands, while associated foraging habitat includes irrigated pastures and alfalfa fields (Twedt and Crawford 1995, Jamarillo 2008, Figure 12-45). There are two CNDDB occurrences from the 1800s of yellow-headed blackbird in the study area; one in CZ 7, which is no longer freshwater marsh habitat, and one in CZ 3 (California Department of Fish and Wildlife 2013). In addition, four confirmed yellow-headed blackbird occurrences were detected in the south central Delta during 2009 and 2010 DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) but breeding was not confirmed for the species.

Riparian Brush Rabbit

The riparian brush rabbit, which is listed as endangered under both ESA and CESA, is a riparian obligate species found in association with a dense shrub layer typically located under an open canopy of valley oaks (Williams et al. 2008). Brush rabbits are dependent on brushy understory cover for protection and use tunnels beneath dense vegetation to avoid predators (Orr 1940, Chapman 1971). Populations of the riparian brush rabbit are known to have occurred historically in riparian forests along the San Joaquin and Stanislaus Rivers and some tributaries to the San Joaquin River (U.S. Fish and Wildlife Service 1998). As a result of habitat loss and fragmentation, the species has since been reduced to populations in only two areas: an approximately 258-acre patch in Caswell Memorial State Park on the Stanislaus River, immediately southwest of the study area; and several small, isolated or semi-isolated patches totaling approximately 270 acres along Paradise Cut and Tom Paine Slough and channel of the San Joaquin River in the south Delta, within CZ 7 in the study area (Figure 12-46) (Williams et al. 2002 and 2008). Recently, on October 11, 2012, a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. The study area consists of a large proportion of the species' total range (see BDCP Appendix 2.A, *Covered Species Accounts*).

DWR conducted surveys for both the riparian brush rabbit and riparian woodrat (described below) in the Plan Area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) during 2008 and 2009. A total of 296 parcels were surveyed over the three field seasons, but neither species was captured during three seasons of trapping. Access restrictions limited the number of sites with high-value habitat available for survey. From intensive field work in the Stewart Tract area (since 1998) and in other nearby areas (Caswell Memorial State Park, Buffington Tract, Faith Ranch, San Joaquin River NWR) over the past 10–30 years, there is every reason to believe that one or both species are also present in similar habitat at the southern end of the study area. Populations of riparian brush rabbit are present in these more southern areas of the study area, where the California State University, Stanislaus, Endangered Species Recovery Program and its federal and state partner agencies have initiated a captive propagation and reintroduction program for the species using breeders from the Stewart Tract area. In addition, since 2003, 30 brush rabbits have been captured at the San Joaquin River NWR and many more have been captured at Caswell Memorial State Park. It is believed that there is a greater probability of documenting riparian brush rabbit and perhaps riparian woodrat in areas south of SR 4 and SR 12 (mostly in San Joaquin County) than in central and northern parts of the study area; however, these species could be present in the central and northern parts of the study area.

Riparian Woodrat

The riparian woodrat, which is listed as endangered under ESA and as a California species of special concern, is a riparian obligate species whose typical habitat includes a canopy of valley oak and a moderate to dense shrub understory with abundant dead branches and downed woody material (Williams 1986).

There are three extant CNDDB riparian woodrat occurrences in the species' range, none of which are in the study area (California Department of Fish and Wildlife 2013). The current known range of the species is confined to a small area in northern San Joaquin County immediately south of the study area, with the nearest known extant CNDDB occurrence approximately 1.5 to 2 miles to the southeast of CZ 7, in Caswell State Park (Figure 12-47). An additional extant population might occur just outside the study area, near Vernalis along the San Joaquin River, although there have been no sightings of the species at this location since the 1970s (Williams and Kilburn 1992). Based on the proximity of these occurrences, the riparian woodrat potentially occurs in suitable habitat in the study area, in CZ 7, or could occupy this area in the future (see BDCP Appendix 2.A, *Covered Species Accounts)*. See riparian brush rabbit discussion above for information on DHCCP survey results for riparian woodrat and potential for occurrence in the study area.

Salt Marsh Harvest Mouse

Salt marsh harvest mouse is endemic to salt marshes of San Francisco, San Pablo, and Suisun Bays. Salt marsh harvest mouse, which is listed as endangered under both ESA and CESA and which is a fully protected species under the Fish and Game Code, is found primarily in tidal brackish emergent wetlands dominated by pickleweed. The species is also known to use areas of managed wetland. In Suisun Marsh it is known to use areas of tidal wetlands and managed wetland. Areas containing mixed wetland vegetation appear to be just as preferable to salt marsh harvest mouse as areas dominated by pickleweed (Sustaita et al 2011). The species also requires escape cover during high tides, which has been modeled as upland habitat within 150 feet of the wetted edge, which may include areas of grassland, valley/foothill riparian and some areas mapped as alkali seasonal wetlands. The species distribution within the study area is thought to extend from Suisun Marsh eastward along the northern edge of the Sacramento River and eastward along the southern edge of the San Joaquin River as far east as the vicinity of Collinsville and Antioch west of Sherman Island (LSA Associates 2007) (Figure 12-48). There are 137 extant records for salt marsh harvest mouse across its range, 48 of which occur within the study area (California Department of Fish and Wildlife 2013).

San Joaquin Kit Fox

The San Joaquin kit fox, which is listed as endangered under ESA and threatened under CESA, is restricted to modeled grassland habitat along the study area's southwestern edge in CZs 7–10. The study area represents the extreme northeastern corner of the species' range in California, which extends westward and southward from the Plan Area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007a). CNDDB (California Department of Fish and Wildlife 2013). reports twelve occurrences of San Joaquin kit foxes along the extreme western edge of the Plan Area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007b) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox.

In the vicinity of the study area, San Joaquin kit foxes inhabit grazed grasslands and grasslands with associated wind farms. The species also sometimes occurs adjacent to and forages in tilled and fallow fields and irrigated row crops (Bell 1994). Remaining patches of northern hardpan vernal pool, northern claypan vernal pool, alkali meadow, and alkali playa types also provide foraging habitat when in association with grasslands or other suitable denning habitats.

Dens are typically in relatively flat terrain or in gently sloping hills, washes, drainages, and roadside berms. Occupied habitats are usually associated with loose-textured soils to facilitate den construction (Grinnell et al 1937, Egoscue 1962, Morrell 1972). Shallow soils with close proximity to bedrock, soils with high water tables, and impenetrable hardpan layers are generally avoided (Morrell 1972, O'Farrell and Gilbertson 1979, O'Farrell et al. 1980, McCue et al. 1981). Kit foxes will also modify burrows dug by other animals, such as California ground squirrel.

Suisun Shrew

Suisun shrew, a California species of special concern, is typically found in dense, low-lying vegetation in tidal marshes. It uses adjacent upland habitats as refugia during prolonged flooding. Suisun shrew is currently found along the northern borders of San Pablo and Suisun bays and in Suisun Marsh, Southampton Marsh, the Napa Marshes, and as far east as Grizzly Island (Figure 12-50). The species distribution in the study area is limited to the general Suisun Marsh area and its modeled habitat in the Plan Area consists of tidal brackish emergent wetland and grassland areas within 150 feet of the wetted edge. There are 15 extant records for Suisun shrew across its range, six of which occur within the study area (California Department of Fish and Wildlife 2013).

Special-Status Bat Species

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (1998) (Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats. No surveys were conducted in 2010. With the availability for access to new parcels, additional habitat assessments were conducted in 2011. The results are summarized briefly below (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report* for details on methods and results, and Table 12A-2 in Appendix 12A).

DHCCP positively identified nine special-status bat species and detected potential calls of two additional special-status bat species (pallid bat and canyon bat) that could not be confirmed with 90% confidence (Table 12-5). Two other bats, the western mastiff bat and Townsend's big-eared bat, were not detected during the DHCCP surveys but have potential to occur in the study area.

Table 12-5. Bat Species Identified from Acoustic Monitoring at 20 Locations in 10 Habitat Types

		Species of Special Concern		Common Species									
Habitat Type	Number of Parcels (*N*)	Western Red	Pallid	Yuma Myotis	California Myotis	Canyon Bat	Western Small-Footed Myotis	Little Brown Myotis	Big Brown	Silver-Haired	Hoary	Mexican Free-Tailed	Total Bat Species (Confirmed and Potential)
Grassland/Disturbed	3	P[a]		X[b]				X	X		X	X	6
Grassland/Riparian Scrub	1			X	X		X	X	X			X	6
Agriculture	3	X		X	P	P	P	X	X		X	X	9
Vineyard	1	X	P	X	X	P		X	P	P	X	X	10
Residential	1	X		X	X		X	X	X	P	P	X	9
Orchard	1	X	P	P	X	P	X		P		X	X	9
Riparian Forest	5	X		X	X	P	X	X	X	P	X	X	10
Oak Forest with Slough	2	P		X	X	P	X	X	X	P	P	X	10
Wetland	2	X		X	X		X	X	X		X	X	8
Eucalyptus	1	X	P			P		X		X	X	X	7

Source: Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report.*

[a] Potential call of this species but lacks species-distinguishing characteristics.

[b] Confirmed bat species with at least 90% confidence.

X = confirmed.

P = potential.

The majority of the parcels assessed during 2009 and 2011 contained bat foraging and roosting features and were considered highly suitable habitat. Nearly all of the highly suitable parcels contained wetlands, channels, sloughs, ponds, or irrigation ditches associated with agricultural land uses. Nearly all of the highly suitable parcels also contained large trees, buildings, barns, or sheds that could support roosting bats. At the time of the 2009 field surveys, evidence of bat presence (bats, guano, urine staining, odor, or vocalizations) was observed on the undersides of 32 of the 145 existing bridges in the study area. Bats were observed under six of the bridges including four bridges with Mexican free-tailed bats and two bridges with unidentified bat species. One of the bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 unidentified species was observed under a bridge in eastern Solano County. Surveyors found guano that was segmented at two potential night roost locations underneath concrete box beam bridges that spanned large flowing waterways. Segmented guano could indicate the presence of Townsend's big-eared bat, which was not confirmed. Neither of these bridges would provide day or maternity roosting for Townsend's big-eared bats.

Bat Species Detected in the Study Area

- **Big brown bat:** Occurs throughout California. Roosts opportunistically in buildings, bridges, palm thatch, snags, tree hollows and in rock crevices. Forages over wide range of habitats. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **California myotis:** Roosts alone or in small groups in crevices and cavities in trees and rocks; occasionally roosts in human structures. Maternity colonies of up to 52 individuals have been documented in large snags and under tree bark. Forages over a variety of habitats, including arid habitats, open lands, forest canopies, forest margins, and water. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Hoary bat:** Ranges widely, but populations in the Central Valley are most likely migratory, not reproductive. Typically roosts alone in a variety of broadleaf tree species such as cottonwood and sycamore; also found roosting in conifers. May be found in a range of vegetation and roost substrates during migration. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Documented occurrence during migration in the Montezuma Hills, adjacent to study area (Sacramento Municipal Utility District 2010). There are four CNDDB (2013) recorded occurrences.

- **Little brown myotis:** Roosts opportunistically in a variety of structures from trees to buildings. Forages in a range of habitats, but typically over water. Likely fall latitudinal or elevational migrant to colder areas with caves of suitable temperature regime for hibernation. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Mexican free-tailed bat:** Roosts in large colonies in bridges and buildings in the Central Valley; breeding colonies may be concentrated in relatively few sites. Also roosts in caves, rock crevices, mines and tunnels. Forages over a range of habitats. One of the larger known breeding colonies in California occurs under the I-80 bridge in the Yolo Bypass. This species was detected in the Plan Area under four bridges 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Silver-haired bat:** Typically roosts in tree cavities, crevices and under loose bark. May also use leaf litter, buildings, mines and caves. Breeds in coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats; may occur in any habitat during migration. Breeding range does not include the Delta, which lacks suitable habitat; only a few scattered breeding locations are known in the San Francisco Bay Area, Central Valley, or central coast, all outside of the legal Delta. May occur throughout California during migration. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Documented occurrence in the Montezuma Hills, adjacent to the study area (Curry et al. 2010).

- **Western red bat:** Historically used old-growth riparian habitat. Highly tied to riparian vegetation for all life stages. Red bats use riparian and associated habitat (orchards) for all of their life stages, including roosting and feeding in riparian zones. Mature riparian broadleaf forest in the Central Valley is primary summer breeding habitat for the species in California (females and pups). Riverside orchards may also be used as maternity roosts. Roosts alone or in small family groups in tree foliage and occasionally in shrubs; prefers habitat edges and mosaics with trees that are protected from above and open below with open areas for foraging, including grasslands, shrublands, and open woodlands. Documented foraging in most habitat types in the Delta; roosting documented in the Delta in Brannan Island State Recreation Area near the central portion of the western conveyance alignment in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Occurrence documented during the fall in the Montezuma Hills (Sacramento Municipal Utility District 2010). Acoustical records during maternity season at several locations within the planning area (Pierson et al. 2006). There are six CNDDB (2013) recorded occurrences in the study area.

- **Western small-footed myotis:** Particularly associated with coniferous forests and rocky xeric habitats. Typically roosts in rock crevices in mines, caves, and occasionally in buildings, bridges and other human structures. Forages over a variety of habitats. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Yuma myotis:** Strongly associated with water sources. Roosts in a variety of structures, including bridges, buildings, caves, mines, trees and rock crevices. Has been known to roost in cliff swallow nests. Typically forages low over water. This species was detected in the Plan Area in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Bat Species with Potential to Occur in the Study Area

- **Canyon bat:** Found in arid habitats throughout California and in lower elevation montane forests with significant rocky areas. Typically roosts in or under rocks, in crevices in cliffs, rocky slopes or scattered boulders. Unsubstantiated records of roosting in burrows. Could occur in the Delta but not expected in significant numbers because of limited suitable habitat. Potential calls identified during DHCCP 2009 acoustic surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Pallid bat**: Occurs in deserts, grasslands, shrublands, woodlands, and forests; most common in open, dry habitats; typically roosts in rock crevices, also in tree hollows, bridges, and buildings, in colonies ranging from one to more than 200 individuals. May roost and forage throughout the Delta, with the highest likelihood in the uplands that surround Clifton Court Forebay. Potential call identified during acoustic surveys by DHCCP in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- **Townsend's big-eared bat:** The Townsend's big-eared bat has never been reported in the study area or its vicinity. However, the species is known to occur at three mine sites on the Little Blue Ridge in northwestern Yolo County, and at two sites in Alameda County, one near Calaveras Reservoir and the other in the hills south of Livermore (California Department of Fish and Wildlife 2013). The closest occurrence is approximately 6.4 miles from the study area. The study area does not contain caves or mines, which are often used as roosting habitat by Townsend's big-eared bats. However, some populations of Townsend's big-eared bat use buildings and other man-made structures, such as tunnels and bridges, and individuals have been reported to use basal hollows in large trees as roost sites. Possible Townsend's bat guano was identified under two of the bridges during the 2009 DHCCP bridge surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The species forages primarily along edges of wooded habitats and along streams (Kunz and Martin 1982). Thus, the species has the potential to occur in the study area, where it would likely forage and roost along larger riparian corridors.

- **Western mastiff bat:** Typically roosts in crevices in cliffs and rocky outcrops, in colonies of fewer than 100 individuals. May also roost in bridges, caves and buildings that allow sufficient height and clearance for dropping into flight. There is at least one record of this species roosting in an untrimmed palm tree. Forages in a variety of grassland, shrub, and wooded habitats, including riparian and urban areas, although most commonly in open, arid lands. May occur throughout the Delta but suitable roosting habitat is limited. Not detected during DHCCP acoustic surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

San Joaquin Pocket Mouse

The San Joaquin pocket mouse inhabits grassland and scrub habitats with friable soils. The species has a NatureServe conservation status of apparently secure, but a status ranging from imperiled to vulnerable in California. Its year-round range spans the San Joaquin Valley, Delta, Sacramento Valley through Colusa County, and portions of the southern Coast Ranges. The species may occur in grasslands in the study area that contain friable soils (Figure 12-52). There are 109 CNDDB records for San Joaquin pocket mouse across its range. There are two CNDDB records of San Joaquin pocket mouse in the southern portion of the Delta in CZ 8 near Clifton Court Forebay (California Department of Fish and Wildlife 2013).

American Badger

Within the study area, habitat for American badger, a state species of special concern, is restricted to grassland along the Plan Area's southwestern edge in CZs 7–10 (Figure 12-53). The study area represents the extreme northeastern corner of the species' range in California, which extends westward and southward from the study area border. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

12.1.3.3 Special-Status Plant Species

Table 12A-1 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area,* presents detailed information on the special-status plant species known or with potential to occur in study area and includes their common and scientific name, listing status (federal, state, and CNPS), notes on the species habitat, distribution in California, flowering period, and potential for occurrence in the study area. Nineteen of these species are covered species in the BDCP. The other 67 species are noncovered species, 36 of which are addressed only in this EIR/EIS. Noncovered species in Table 12A-1 that are not known to occur in the study area and that would not be affected by the action alternatives were not addressed further.

The following summaries provide information on the plant species habitat requirements, distribution, and occurrences within the study area. The habitat and distribution information for covered species is largely based on the species account information found in Appendix 2.A *Covered Species Accounts*, of the BDCP. The habitat and distribution information for noncovered species was developed for the EIR/EIS by ICF staff. The habitat models for noncovered species described below were based on one or more of the following characteristics: species range; natural communities in which they are found; specific vegetation alliances within each natural community; and occurrence records. Species occurrence data were obtained from the CNDDB and from field surveys conducted in support of the DHCCP (Appendix 12C, *2009–2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Vernal Pool Plants

Alkali Milk-Vetch

Alkali milk-vetch, which has a CRPR of 1B.2, is known from the southern Sacramento Valley, northern San Joaquin Valley, and the eastern San Francisco Bay Area (Wojciechowski and Spellenberg 2012 p. 750). It grows in alkali grassland and alkali vernal pools and playas (California Department of Fish and Wildlife 2013). Alkali seasonal wetland complex, vernal pool complex, and managed wetland are the natural community types in the study area that may provide habitat for alkali milk-vetch (Figure 12-54). Occurrences have been reported within or abutting CZ 1 (six records), CZ 2 (four records), CZ 6 (one record), CZ 8 (two records), and CZ 11 (four records) (California Department of Fish and Wildlife 2013). The threats to alkali milk-vetch are development, competition from nonnative plants, trampling, energy transmission line construction, and habitat destruction, particularly from the conversion of habitat to agriculture (California Native Plant Society 2012a).

San Joaquin Spearscale

San Joaquin spearscale, which has a CRPR of 1B.2, is known from the western edge of the Central Valley and adjacent foothills from Glenn County to Tulare County (Zacharias 2012 p. 634). It grows in iodine bush scrub, alkali meadow, and alkali grasslands (California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for San Joaquin spearscale are grassland and alkali seasonal wetland complex (Figure 12-54). San Joaquin spearscale occurrences have been reported within or abutting CZ 1 (two records), CZ 5 (one record), CZ 6 (one record), CZ 8 (seven records), CZ 9 (four records), and CZ 11 (five records) (California Department of Fish and Wildlife 2013). The threats to San Joaquin spearscale are grazing, agriculture, and development (California Native Plant Society 2012d).

Dwarf Downingia

Dwarf downingia, which has a CRPR of 2.2, is known from the inner North Coast Ranges, southern Sacramento Valley, and the northern and central portions of the San Joaquin Valley (Schultheis 2012 p. 591). It occurs in vernal pools (Schultheis 2012 p. 591, California Department of Fish and Wildlife 2013). The natural community type in the study area that may provide habitat for dwarf downingia is vernal pool complex (Figure 12-54). Dwarf downingia occurrences have been reported within or abutting CZ 1 (eight records), CZ 4 (one record), and CZ 11 (three records) (California Department of Fish and Wildlife 2013). The threats to dwarf downingia are competition from nonnative plants, urbanization, development, agriculture, grazing, vehicles, and industrial forestry (California Native Plant Society 2012h).

Boggs Lake Hedge-Hyssop

Boggs Lake hedge-hyssop, which is state-listed as endangered and has a CRPR of 1B.2, is a vernal pool endemic known from the inner North Coast Ranges, central Sierra Nevada foothills, Sacramento Valley, the Modoc Plateau, and one occurrence in Oregon (Estes 2012 p. 1012). The natural community type in the study area that provides habitat for Boggs Lake hedge-hyssop is vernal pool complex. A single CNDDB occurrence has been reported within CZ 1 (Figure 12-54) (California Department of Fish and Wildlife 2013). Threats to Boggs Lake hedge-hyssop are agriculture, development, grazing, trampling, and vehicles (California Native Plant Society 2012j).

Legenere

Legenere, which has a CRPR of 1B.1, is known from the southern Sacramento Valley, southern North Coast Ranges, northern San Joaquin Valley, Santa Cruz Mountains, and Mount Hamilton ranges (Morin 2012 p. 594). It occurs in vernal pools and other seasonal wetlands (California Department of Fish and Wildlife 2013). The natural community type in the study area that provides habitat for legenere consists of vernal pool complex (Figure 12-54). Legenere occurrences have been reported within or abutting CZ 1 (five records), CZ 4 (two records), and CZ 11 (one record) (California Department of Fish and Wildlife 2013). Threats to legenere are grazing, road widening, competition from nonnative plants, and development (California Native Plant Society 2012m).

Heckard’s Peppergrass

Heckard’s peppergrass, which has a CRPR of 1B.2, is known from the Sacramento Valley and northern San Joaquin Valley (California Department of Fish and Wildlife 2013). It occurs in alkali grasslands, alkali meadow, and alkali vernal pools (California Department of Fish and Wildlife 2013). Alkali seasonal wetland complex and vernal pool complex are the natural community types in the study area that may provide habitat for Heckard’s pepper grass (Figure 12-54). Heckard’s peppergrass occurrences have been reported in CZ 1 (one record), CZ 2 (two records), and CZ 4 (two records) (California Department of Fish and Wildlife 2013). Reported threats to Heckard’s pepper grass include disking for fire breaks and trampling (California Department of Fish and Wildlife 2013).

Ferris’s Milk-Vetch

Ferris’s milk-vetch, which has a CRPR of 1B.1, is historically known from the Central Valley from Butte County to Alameda County but currently occurs only in Butte, Glenn, Colusa, and Yolo Counties (California Department of Fish and Wildlife 2013). It grows in alkali meadows and alkaline flats, often on clay soils (Wojciechowski and Spellenberg 2012 p. 750, California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for Ferris’s milk-vetch are alkali seasonal wetland complex and vernal pool complex (Figure 12-54). Occurrences of Ferris’s milk-vetch have been reported within or abutting CZ 1 (one record) and CZ 2 (two records) (California Department of Fish and Wildlife 2013), and in CZ 8 (three records). Threats to Ferris’s milk-vetch are habitat conversion and degradation and grazing.

Vernal Pool Smallscale

Vernal pool smallscale, which has a CRPR of 1B.2, is known from widely scattered occurrences in the Central Valley from Colusa County to Tulare County (California Department of Fish and Wildlife 2013). It grows in alkali vernal pools (Zacharias 2012 p. 636). The natural community type in the study area that may provide habitat for vernal pool smallscale is vernal pool complex (Figure 12-54). Occurrences of vernal pool smallscale have been reported within CZ 1 (one record) and CZ 11 (one record) (California Department of Fish and Wildlife 2013). Possible threats to vernal pool smallscale are flood-management activities and agriculture (California Native Plant Society 2012t).

Hogwallow Starfish

Hogwallow starfish, which has a CRPR of 4.2, is known primarily from the Great Valley region of the California Floristic Province and the adjacent foothills but also occurs in the South Coast and Peninsular ranges (Morefield 2012a: 348). It grows in clay flats, vernal pools, and other habitats with heavy clay soils (Morefield 2012a). Natural community types in the study area that provide habitat for hogwallow starfish are grassland and vernal pool complex (Figure 12-54). Hogwallow starfish was historically collected in Antioch and has been collected at locations adjacent to CZs 1, 2, and 11 (Consortium of California Herbaria 2012f). Threats to hogwallow starfish are agriculture and development (California Native Plant Society 2012jj).

Ferris' Goldfields

Ferris's goldfields, which has a CRPR of 4.2, is known from the Sacramento and San Joaquin Valleys and the valleys of the adjacent foothills (Consortium of California Herbaria 2012g). It occurs in alkaline vernal pools and wet saline flats (Chan and Ornduff 2012, p. 367). Natural community types in the study area that provide habitat for Ferris' goldfields consist of alkali seasonal wetland complex and vernal pool complex. Ferris' goldfields occurrences are present in CZs 8 and 9 (Figure 12-54). Ferris' goldfields occurrences in Contra Costa County are locally significant because they are at the northwestern edge of the species distribution. Threats to Ferris' goldfields are development and agriculture (California Native Plant Society 2012nn).

Cotulaleaf Navarretia

Cotulaleaf navarretia, which has a CRPR of 4.2, has a limited distribution in the inner North Coast Ranges, Sacramento Valley, San Francisco Bay Area, and northern South Coast Ranges (Consortium of California Herbaria 2012h). It occurs in heavy clay soils of vernal pools, seasonal alkali wetlands, and grasslands. Natural community types in the study area that provide habitat for coltulaleaf navarretia consist of alkali seasonal wetland complex, vernal pool complex, and grassland (Figure 12-54). Cotulaleaf navarretia occurrences in Contra Costa County are locally significant because they are at the southern end of the species distribution. Threats to cotulaleaf navarretia are nonnative plants and habitat alteration (California Native Plant Society 2012yy).

Contra Costa Goldfields

Contra Costa goldfields is federally listed as endangered and has a CRPR of 1B.1. Contra Costa goldfields is known from scattered occurrences in the southwestern edge of the Sacramento Valley and the valleys of the San Francisco Bay Area and the Central Coast (Chan and Ornduff 2012 p. 366). It grows in vernal pools, swales, and wet meadows (Chan and Ornduff 2012 p. 366, California Department of Fish and Wildlife 2013). The natural community type in the study area that provides potential habitat for Contra Costa goldfields is vernal pool complex (Figure 12-54). Occurrences of Contra Costa goldfields have been reported within and adjacent to CZ 10 (one record) and CZ 11 (six records) (California Department of Fish and Wildlife 2013). Threats to Contra Costa goldfields are development, alterations to habitat (including hydrology), overgrazing, and competition with nonnative plants (California Native Plant Society 2012mm).

Baker's Navarretia

Baker's navarretia, which has a CRPR of 1B.1, is known from the inner North Coast Ranges and western Sacramento Valley (California Department of Fish and Wildlife 2013). It occurs in vernal pools and swales on clay or alkali soils (California Department of Fish and Wildlife 2013). The natural community type in the study area that provides habitat for Baker's navarretia is vernal pool complex. Baker's navarretia has been reported adjacent to the study area and in CZs 1 and CZ 2 (Figure 12-54) (California Department of Fish and Wildlife 2013). Threats to Baker's navarretia are agriculture, development, habitat alteration, and road construction (California Native Plant Society 2012oo).

Colusa Grass

Colusa grass is federally listed as threatened, state-listed as endangered, and has a CRPR of 1B.1. Colusa grass is known from the Central Valley with scattered occurrences from Colusa County to Merced County (Reeder 2012). It grows in the bottoms of large, deep vernal pools (California Department of Fish and Wildlife 2013). The natural community type in the study area that provides habitat for Colusa grass is vernal pool complex. One occurrence of Colusa grass is present in CZ 1 and other occurrences are adjacent to CZs 1 and 2 (Figure 12-54) (California Department of Fish and Wildlife 2013). Threats to Colusa grass are competition with nonnative plants, agriculture, development, overgrazing, and flood-management actions (California Native Plant Society 2012pp).

Bearded Popcorn-Flower

Bearded popcorn-flower, which has a CRPR of 1B.1, is present in the southern interior North Coast Range and the southern Sacramento Valley (Preston et al. 2010). Bearded popcorn-flower was presumed extinct until rediscovered in 2005 (Preston et al. 2010). It occurs in vernal pools and vernal swales and also in other vernally moist areas in grasslands (Preston et al. 2010). Natural community types in the study area that provide habitat for bearded popcorn-flower are vernal pool complex and grassland (Figure 12-54). Bearded popcorn-flower occurs within CZs 2 and 11 (California Department of Fish and Wildlife 2013). Threats to bearded popcorn-flower are disking, development, and competition with nonnative plants (California Native Plant Society 2012rr).

Saline Clover

Saline clover, which has a CRPR of 1B.2, is known from the Sacramento Valley, the northwestern San Joaquin Valley, the San Francisco Bay Area, and the Central Coast (Vincent and Isely 2012 p. 795). It occurs in marshes, vernal pools and swales, and iodine bush scrub, generally on saline or alkaline soils (California Department of Fish and Wildlife 2013). Alkali seasonal wetland complex, vernal pool complex, and tidal brackish emergent wetland are the natural community types in the study area that provide potential habitat for saline clover (Figure 12-54). Eight occurrences of saline clover have been reported in CZ 1 (one record), CZ 2 (one record), CZ 4 (five records), and CZ 11 (one record) (California Department of Fish and Wildlife 2013). Threats to saline clover are development, trampling, road construction, and vehicles (California Native Plant Society 2012ww).

Solano Grass

Solano grass is federally and state-listed as endangered and has a CRPR of 1B.1. Solano grass is known from only three occurrences in the southwestern Sacramento Valley in Solano and Yolo Counties, where it grows in vernal pools (California Department of Fish and Wildlife 2013). The natural community type in the study area that provides habitat for Solano grass is vernal pool complex. All three CNDDB records for Solano grass are located within or adjacent to CZs (Figure 12-54). One CNDDB record of Solano grass occurs within CZ 11, and the other occurrences are adjacent to CZ 1 (California Department of Fish and Wildlife 2013). Competition from nonnative plants is a threat to Solano grass (California Native Plant Society 2012xx).

Delta Woolly-Marbles

Delta woolly-marbles has a CRPR of 4.2. It is known from scattered locations in the Sacramento Valley, San Francisco Bay Area, and northern San Joaquin Valley (Morefield 2012b: 407). It grows in vernal pools. The natural community type that provide habitat for Delta woolly-marbles is vernal pool complex. Three occurrences are present in the study area, one in CZ 1, one in CZ 4, and one in CZ 11 (Figure 12-54) (Consortium of California Herbarium 2012h). Delta woolly-marbles is locally uncommon in the study area. Current threats for Delta woolly-marbles are unknown but are likely to include habitat alteration (California Native Plant Society 2012bbb).

Alkali Seasonal Wetland Plants

Brittlescale

Brittlescale, which has a CRPR of 1B.2, is known from the eastern and western portions of the Central Valley and the adjacent foothills on the Central Valley's west side (Zacharias 2012 p. 633–634, California Department of Fish and Wildlife 2013). It grows in iodine bush scrub and alkali grasslands on the margins of vernal pools, swales, slickspots and scalds (California Department of Fish and Wildlife 2013). Alkali seasonal wetland complex, and vernal pool complex are the natural community types in the study area that may provide habitat for brittlescale (Figure 12-55). Brittlescale occurrences have been reported within or abutting CZ 1 (two records), CZ 8 (two records), and CZ 11 (three records) (California Department of Fish and Wildlife 2013). The threats to brittlescale are development, grazing, and trampling (California Native Plant Society 2012c).

Heartscale

Heartscale, which has a CRPR of 1B.2, is known from the western side of the Central Valley and the valleys of adjacent foothills (Zacharias 2012 p. 633, California Department of Fish and Wildlife 2013). It grows in iodine bush scrub, alkali meadow, and alkali grasslands on the margins of vernal pools, swales, slickspots and scalds (California Department of Fish and Wildlife 2013). The natural community types in the study area that may provide heartscale habitat is alkali seasonal wetland complex (Figure 12-55). Heartscale occurrences have been reported within or abutting CZ 1 (three records), CZ 6 (one record), CZ 8 (one record), and CZ 11 (one record) (California Department of Fish and Wildlife 2013). The threats to heartscale are competition from nonnative plants and trampling (California Native Plant Society 2012b).

Delta Button Celery

Delta button celery, which is state-listed as endangered and has a CRPR of 1B.1, occurs in the northern San Joaquin Valley (Preston et al. 2012 p. 182). It is associated with vernally mesic depressions that occur within the historic floodplain of the San Joaquin River, which can be characterized as vernal pool complex or, when stands of trees and shrubs occur in a mosaic with open areas of pools and swales, as valley/foothill riparian (Figure 12-55) (California Department of Fish and Wildlife 2013). Three Delta button celery occurrences have been reported within or abutting CZ 7 (two records) and CZ 9 (one record) (California Department of Fish and Wildlife 2013). The threats to Delta button celery are flood-management activities, competition from nonnative plants, and agriculture (California Native Plant Society 2012i).

Crownscale

Crownscale, which has a CRPR of 4.2, is known from the southern Sacramento Valley, eastern San Joaquin Valley, eastern San Francisco Bay Area, and the inner South Coast Ranges (Zacharias 2012 p. 633). It occurs in chenopod scrub, alkaline grassland, and alkaline vernal pools (California Native Plant Society 2012zz). Alkali seasonal wetland complex and vernal pool complex are the natural community types that may provide habitat for crownscale in the study area. Occurrences of crownscale have been reported in CZs 7, 8 9, and 11 (Figure 12-55) (Consortia of California Herbaria 2012a). In addition, reported occurrences of heartscale and Lost Hills crownscale from the vicinity of Byron are presumed to be crownscale (R. Preston pers. comm.). Crownscale occurrences in the study area are locally significant because they are at the northern edge of the species distribution.

Palmate-Bracted Bird’s-Beak

Palmate-bracted bird’s-beak, is federally and state-listed as endangered and has a CRPR of 1B.1. Palmate-bracted bird’s-beak is known from the Livermore Valley and scattered locations in the Central Valley from Colusa County to Fresno County (Wetherwax and Tank 2012 p. 966; California Department of Fish and Wildlife 2013). It occurs in iodine bush scrub, alkali meadow, and alkali grassland, often on the margins of swales, scalds, or vernal pools (California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for palmate-bracted bird’s-beak are alkali seasonal wetland complex and vernal pool complex (Figure 12-55). A single occurrence of palmate-bracted bird’s-beak was reported in CZ 6 near Stockton, but it was last observed in 1881 and is possibly extirpated (California Department of Fish and Wildlife 2013). Threats to palmate-bracted bird’s-beak are agriculture, urbanization, vehicles, altered hydrology, grazing, and development (California Native Plant Society 2012z).

Recurved Larkspur

Recurved larkspur, which has a CRPR of 1B.2, was formerly widespread in the Central Valley from Colusa County to Kern County, although it has been extirpated from the Sacramento Valley (Koontz and Warnock 2012 p. 1411; California Department of Fish and Wildlife 2013). It occurs in chenopod scrub and grassland on poorly drained, fine, alkaline soils (Koontz and Warnock 2012 p. 1411). Natural community types in the study area that may provide habitat for recurved larkspur are grassland and seasonal alkali wetland complex. Four occurrences of recurved larkspur have been reported in CZ 8 (Figure 12-55) (California Department of Fish and Wildlife 2013). Threats to recurved larkspur are grazing and trampling (California Native Plant Society 2012cc).

Grassland Plants

Caper-Fruited Tropidocarpum

Caper-fruited tropidocarpum, which has a CRPR of 1B.1, is historically known from the northwest San Joaquin Valley and adjacent Diablo Range foothills and has recently been reported from Fresno, Monterey, and San Luis Obispo Counties (California Department of Fish and Wildlife 2013). It grows in alkali grasslands. Grassland and alkali seasonal wetland complex are the natural community types in the study area that may provide habitat for caper-fruited tropidocarpum (Figure 12-56). Occurrences of caper-fruited tropidocarpum have been reported within or abutting CZ 7 (four records), CZ 8 (two records), and CZ 9 (one record) (California Department of Fish and Wildlife 2013). Possible threats to caper-fruited tropidocarpum are grazing, military activities, competition with nonnative plants, and trampling (California Native Plant Society 2012r).

Carquinez Goldenbush

Carquinez goldenbush, which has a CRPR of 1B.1, is known from the southern Sacramento Valley between Jepson Prairie and Suisun Marsh (Keil 2012b p. 360, California Department of Fish and Wildlife 2013). It occurs in grasslands with alkali soils. The natural community type in the study area that provides habitat for Carquinez goldenbush is grassland (Figure 12-56). Carquinez goldenbush occurrences have been reported within or abutting CZ 1 (three records) and CZ 11 (seven records) (California Department of Fish and Wildlife 2013). Probable threats to Carquinez goldenbush are development and agriculture (California Native Plant Society 2012k).

Big Tarplant

Big tarplant, which has a CRPR of 1B.1, is known from the eastern San Francisco Bay Area and northwestern San Joaquin Valley (Baldwin 2012a). It occurs in annual grasslands on clay to clay-loam soils, usually on slopes (California Department of Fish and Wildlife 2013). The natural community type in the study area that may provide habitat for big tarplant is grassland (Figure 12-56). Occurrences of big tarplant have been reported in CZ 7 (one record) and CZ 10 (three records) and adjacent to CZ 6 (one record) (California Department of Fish and Wildlife 2013). Residential development poses a threat to big tarplant. The extirpation of historical occurrences is likely the result of agriculture and competition from nonnative plants (California Native Plant Society 2012u).

Round-Leaved Filaree

Round-leaved filaree, which has a CRPR of 1B.1, is known from scattered occurrences in the Central Valley, southern North Coast Ranges, San Francisco Bay Area, South Coast Ranges, Channel Islands, Transverse ranges, and Peninsular ranges (Alarcón et al. 2012). It occurs in grasslands and open, grassy areas in oak woodland (California Department of Fish and Wildlife 2013). The natural community type in the study area that may provide habitat for round-leaved filaree is grassland (Figure 12-56). Four occurrences of round-leaved filaree have been reported within or adjacent to CZ 6 (one record), CZ 7 (two records), and CZ 10 (one record) (California Department of Fish and Wildlife 2013). Threats to round-leaved filaree are habitat alteration, feral pigs, vehicles, competition from nonnative plants, urbanization, pipeline construction, and possibly grazing (California Native Plant Society 2012v).

Pappose Tarplant

Pappose tarplant, which has a CRPR of 1B.2, is known from the northern Central Coast, the North Coast Ranges, and the southern Sacramento Valley (Baldwin 2012b p. 274). It occurs in grassland, at the margins of coastal salt marsh, and in alkaline seeps and springs (Baldwin 2012b). Natural community types in the study area that may provide habitat for pappose tarplant are alkali seasonal wetland complex and grassland. Eight occurrences of pappose tarplant have been reported within or adjacent to CZ 11 (Figure 12-56) (California Department of Fish and Wildlife 2013). Threats to pappose tarplant are habitat disturbance, agriculture, competition from nonnative species, development, grazing, and road maintenance (California Native Plant Society 2012x).

Parry's Rough Tarplant

Parry's rough tarplant has a CRPR of 4.2. It occurs in scattered grassland remnants in the Sacramento and northern San Joaquin Valleys (Baldwin 2012b p. 274). It occurs in grasslands, sometimes at the margins of marshes or vernal pools, or in ruderal habitat (Baldwin 2012b p. 274). Grassland, alkali seasonal wetland complex, and vernal pool complex are natural community types in the study area that may provide habitat for Parry's rough tarplant (Figure 12-56). Five occurrences of Parry's rough tarplant have been reported from CZs 2, 3, 4, and 6 (Lazar pers. comm.; Consortia of California Herbaria 2012b). Although common and abundant in a few locations, many of the occurrences are small and localized, often small, disturbed patches in road or railroad rights-of-way. Parry's rough tarplant occurrences in the study area are locally significant because the species' habitat in the study area has been greatly diminished and fragmented by conversion to agricultural land (California Native Plant Society 2012y).

Small-Flowered Morning-Glory

Small-flowered morning-glory has a CRPR of 4.2. It occurs at scattered locations in coastal California and the Coast Ranges from Contra Costa County to San Diego County and in the southern Sierra Nevada foothills (Consortium of California Herbaria 2012c). Habitat for small-flowered morning-glory consists of grasslands or open grassy areas in chaparral or coastal sage scrub, usually on clay soils, but sometimes on serpentine soils (Preston and Dempster 2012: 659). Potential habitat for small-flowered morning-glory would be grasslands along the western edges of CZs 7, 8, and 9. Although no occurrences are known from the study area, three occurrences are reported from areas adjacent to the study area, and suitable habitat is present in the study area (Figure 12-56). Small-flowered morning-glory occurrences in Contra Costa County are locally significant because they are at the northern edge of the species distribution and disjunct from the nearest occurrences in Stanislaus County. It is threatened by development and possibly threatened by nonnative plants (California Native Plant Society 2012bb).

Diamond-Petaled California Poppy

Diamond-petaled California poppy, which has a CRPR of 1B.1, was known historically from the interior foothills of the North and South Coast Ranges but is currently known from only three locations in Alameda County and San Luis Obispo County (Hannan and Clark 2012 p. 984, California Department of Fish and Wildlife 2013). The natural community type in the study area that may provide habitat for diamond-petaled California poppy is grassland. Two historic occurrences of diamond-petaled California poppy are in the study area (Figure 12-56). One occurrence overlaps with CZ 7 and CZ 8, and the second occurrence is located within CZ 10 (California Department of

Fish and Wildlife 2013). Threats to diamond-petaled California poppy are agriculture and grazing (California Native Plant Society 2012gg).

Stinkbells

Stinkbells, which has a CRPR of 4.2, is known from the foothills of the North and South Coast Ranges, the Sierra Nevada foothills, and the Central Valley (McNeal and Nees 2012 p. 1388, Consortium of California Herbaria 2012e). It occurs in grasslands and in grassy, open areas in chaparral, oak woodland, and pinyon-juniper woodland, usually on clay or serpentine soils (California Native Plant Society 2012hh). The natural community type in the study area that may provide habitat for stinkbells is grassland. A single occurrence of stinkbells has been reported along the southern boundary of CZ 10 and is presumed extant (Figure 12-56) (California Department of Fish and Wildlife 2013). Threats to stinkbells are development and grazing (California Native Plant Society 2012hh).

Fragrant Fritillary

Fragrant fritillary, which has a CRPR of 1B.2, is known from the southern Sacramento Valley, southern North Coast Ranges, San Francisco Bay Area, and northern Central Coast (California Department of Fish and Wildlife 2013). It occurs in grasslands, coastal prairie, and open, grassy areas in coastal scrub and oak woodlands, often on serpentine soils (California Department of Fish and Wildlife 2013; California Native Plant Society 2012ii). The natural community type in the study area that provides habitat for fragrant fritillary is grassland (Figure 12-56). Occurrences of fragrant fritillary have been reported within CZ 1 (four records) and CZ 11 (one record) (California Department of Fish and Wildlife 2013). Threats to fragrant fritillary are grazing, agriculture, urbanization, competition from nonnative plants, and possibly recreational activities (California Native Plant Society 2012ii).

Streamside Daisy

Streamside daisy has a CRPR of 3, indicating that more information is needed on the distribution and level of threat. However, only 31 occurrences have been recorded (Consortium of California Herbaria 2012d), indicating that the species is rare. The species occurs along the western edge of the Klamath ranges and outer North Coast Ranges from Humboldt County south to Solano County. Dry slopes and rock outcrops, often along rivers, provide habitat for streamside daisy (Keil and Nesom 2012 p. 317). One occurrence is present in CZ 11, west of Interstate 680, and a second occurrence near Cordelia is adjacent to the study area (Figure 12-56).

Gairdner's Yampah

Gairdner's yampah has a CRPR of 4.2. It occurs primarily along the California coast and inland into the North Coast Ranges (Constance and Wetherwax 2012 p. 196). It grows in seasonally wet areas in coastal prairie and grasslands and in open, grassy areas in chaparral and broadleaved upland forest (California Native Plant Society 2012ccc). Although no occurrences are known from the study area, Gairdner's yampah occurs in areas adjacent to CZ 11, and suitable habitat occurs in CZ 11 (Consortium of California Herbaria 2012i). Natural community types in the study area that provide habitat for Gairdner's yampah are grasslands and vernal pool complex (Figure 12-56). Gairdner's yampah occurs in widely scattered locations and is locally uncommon in the study area. Gairdner's yampah is threatened by agriculture, grazing, nonnative plants, habitat alteration, and urbanization (California Native Plant Society 2012ccc).

Keck's Checkerbloom

Keck's checkerbloom is federally listed as endangered. It has no state listing status but has a California Rare Plant Rank of 1B.1 (California Department of Fish and Wildlife 2013). Prior to 2009, Keck's checkerbloom was known from only three occurrences in Tulare County. During a review of specimens in preparation for the revised treatment of Sidalcea for the Jepson Manual second edition, Hill (2009) determined that specimens collected from occurrences in Napa, Yolo, and Solano Counties should also be regarded as Keck's checkerbloom. Therefore, the current range for the species is the southern Inner North Coast Ranges, the southern Sacramento Valley, and the southern Sierra Nevada foothills (Hill 2012a p.893). Habitat for the species usually is grassy areas within blue oak woodland, often on clay soils, at elevations between 280 and 1,950 feet (California Department of Fish and Wildlife 2013; Hill 2012a). Grassland is the natural community type in the study area that may provide habitat for Keck's checkerbloom. No occurrences have been reported from the Plan Area, but two occurrences are adjacent to the east side of CZ 11, one of which is within the study area for the western power alternative (Figure 12-56). Potential threats to Keck's checkerbloom include grazing and competitive from nonnative grasses, and one occurrence has been extirpated by conversion to an orchard (California Department of Fish and Wildlife 2013).

Valley/Foothill Riparian Plants

Delta Button Celery

Delta button celery, which is state-listed as endangered and has a CRPR of 1B.1, occurs in the northern San Joaquin Valley (Preston et al. 2012 p. 182). It is associated with vernally mesic depressions that occur within the historic floodplain of the San Joaquin River, which can be characterized as vernal pool complex or, when stands of trees and shrubs occur in a mosaic with open areas of pools and swales, as valley/foothill riparian (Figure 12-57) (California Department of Fish and Wildlife 2013). Three Delta button celery occurrences have been reported within or abutting CZ 7 (two records) and CZ 9 (one record) (California Department of Fish and Wildlife 2013). The threats to Delta button celery are flood-management activities, competition from nonnative plants, and agriculture (California Native Plant Society 2012i).

Slough Thistle

Slough thistle, which has a CRPR of 1B.1, is known from the San Joaquin Valley in Kern, Kings, and San Joaquin Counties (Keil 2012a p. 285; California Department of Fish and Wildlife 2013). It occurs in freshwater marsh along sloughs and river banks, often in clay or alkali soils (California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for slough thistle are nontidal freshwater perennial emergent wetland and valley/foothill riparian (Figure 12-57). Two CNDDB occurrences of slough thistle have been reported in CZ 7 (California Department of Fish and Wildlife 2013). The threats to slough thistle are agriculture and competition from nonnative plants (California Native Plant Society 2012f).

Northern California Black Walnut

Native stands of northern California black walnut have been assigned a CRPR of 1B.1; however, individual trees of this species are generally considered to be naturalized, rather than native (California Native Plant Society 2012ll). Native stands of northern California black walnut were historically present in the California in the southern portion of the Inner North Coast Ranges, the southern Sacramento Valley, the northern San Joaquin Valley, and the San Francisco Bay Area

(Whittemore 2012 p. 833). The last two native stands of northern California black walnut are located in Napa and Contra Costa Counties but fall outside the study area (California Department of Fish and Wildlife 2013). An historic occurrence, which was reported on both sides of the Sacramento River between Freeport and Rio Vista, is believed to be extirpated (California Department of Fish and Wildlife 2013). The natural community type in the study area that provides potential habitat for northern California black walnut is valley/foothill riparian (Figure 12-57). Threats to northern California black walnut are urbanization, conversion to agriculture, and hybridization with orchard trees (California Native Plant Society 2012ll).

Wright's Trichocoronis

Wright's trichocoronis, which has a CRPR of 2.1, is known from scattered locations in the Central Valley and South Coast (Keil and Powell 2012). It has been found in various wetland types, including alkaline meadow and floodplain wetlands, sometimes in drying mud (California Department of Fish and Wildlife 2013). Natural community types in the study area that provide potential habitat for Wright's trichocoronis consist of nontidal freshwater perennial emergent wetland and valley/foothill riparian. An historic occurrence of Wright's trichocoronis in CZ 7 was last seen in 1914 (Figure 12-57) (California Department of Fish and Wildlife 2013). Wright's trichocoronis is threatened by habitat loss to agriculture and urbanization (California Native Plant Society 2012uu).

Tidal Wetland Plants

Delta Mudwort

Delta mudwort, which has a CRPR of 2.1, is mostly known from the Sacramento-San Joaquin Delta and from a single occurrence in Marin County (Wetherwax 2012). It is native to the East Coast of North America and may have been introduced to California (Wetherwax 2012). It grows on the bare soil of mudflats and river banks and on pilings, riprap, and other exposed substrates (California Department of Fish and Wildlife 2013). Tidal brackish emergent wetland, tidal freshwater emergent wetland, and valley/foothill riparian are the natural community types in the study area that may provide habitat for Delta mudwort (Figure 12-58). Delta mudwort occurrences have been reported within or abutting CZ 1 (one record), CZ 3 (one record), CZ 5 (24 records), CZ 6 (22 records), CZ 8 (four records), CZ 10 (three records), and CZ 11 (three records) (California Department of Fish and Wildlife 2013). Threats to Delta mudwort in California are erosion, recreation, trampling, flotsam deposition, riprap, possible tidal gate installation, grazing on adjacent land, fishing access, streambank alteration for wetlands restoration, trash, levee maintenance/upgrades, rising sea levels, and increased salinity (California Native Plant Society 2012o).

Delta Tule Pea

Delta tule pea, which has a CRPR of 1B.2, occurs in tidal habitats along the margins of San Pablo Bay, Suisun Bay, Suisun Marsh, and the rivers and sloughs of the Delta (California Department of Fish and Wildlife 2013). It grows in brackish and freshwater marsh, generally on the margins of sloughs and marshes (California Department of Fish and Wildlife 2013). Tidal brackish emergent wetland, tidal freshwater emergent wetland, and valley/foothill riparian habitat are the natural community types in the study area that may provide habitat for Delta tule pea (Figure 12-58). Delta tule pea occurrences have been reported within or abutting CZ 1 (five records), CZ 3 (three records), CZ 4 (two records), CZ 5 (30 records), CZ 6 (16 records), CZ 9 (two records), and CZ 11 (47 records)

(California Department of Fish and Wildlife 2013). Threats to Delta tule pea are water diversions, agriculture, and erosion (California Native Plant Society 2012l).

Mason's Lilaeopsis

Mason's lilaeopsis is state-listed as rare under the California Native Plant Protection Act (CNPPA) and has a CRPR of 1B.1. Mason's lilaeopsis occurs in Suisun Bay, Suisun Marsh, and the Delta (California Department of Fish and Wildlife 2013). It grows on the bare soil of mudflats and river banks and on pilings, riprap, and other exposed substrates (California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for Mason's lilaeopsis are tidal brackish emergent wetland, tidal freshwater emergent wetland, and valley/foothill riparian (Figure 12-58). Mason's lilaeopsis occurrences have been reported within or abutting CZ 1 (seven records), CZ 2 (two records), CZ 3 (three records), CZ 4 (one record), CZ 5 (51 records), CZ 6 (59 records), CZ 7 (two records), CZ 8 (14 records), CZ 9 (six records), CZ 10 (eight records), and CZ 11 (26 records) (California Department of Fish and Wildlife 2013). Threats to Mason's lilaeopsis are erosion, channel stabilization, development, flood-management projects, recreation, agriculture, shading resulting from marsh succession, and competition with invasive water hyacinth (*Eichhornia crassipes*) (California Native Plant Society 2012n).

Side-Flowering Skullcap

Side-flowering skullcap, which has a CRPR of 2.2, is known in California from the Delta (California Department of Fish and Wildlife 2013). It is more widespread outside of California, where it ranges north to British Columbia and to the East Coast (Olmstead 2012 p. 856). It occurs in wet meadows and marshes, often on logs (Olmstead 2012 p. 856, California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for side-flowering skullcap consist of tidal freshwater emergent wetland and valley/foothill riparian (Figure 12-58). Side-flowering skullcap occurrences have been reported in CZ 4 (three records) and CZ 5 (nine records) (California Department of Fish and Wildlife 2013). Water recreation and hydrological alterations may be threats to side-flowering skullcap (California Department of Fish and Wildlife 2013, California Native Plant Society 2012p).

Soft Bird's-Beak

Soft bird's-beak, known from the northern Central Coast and the Delta (Wetherwax and Tank 2012 p. 966), is federally listed as endangered, state listed as rare under the CNPPA, and has a CRPR of 1B.2. It grows in coastal salt marsh (Wetherwax and Tank 2012 p. 966, California Department of Fish and Wildlife 2013). Natural community types in the study area that may provide habitat for soft bird's-beak are tidal brackish emergent wetland and managed wetland (Figure 12-58). Soft bird's-beak occurrences have been reported within or abutting CZ 10 (one record) and CZ 11 (13 records) (California Department of Fish and Wildlife 2013). The threats to soft bird's-beak are feral pigs, erosion, competition from nonnative plants, marsh drainage, and trampling (California Native Plant Society 2012e).

Suisun Marsh Aster

Suisun Marsh aster has a CRPR of 1B.2. Suisun Marsh aster occurrences have been reported in the Delta, particularly in Suisun Marsh and Suisun Bay, and in Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties (California Department of Fish and Wildlife 2013). It grows in freshwater marsh, especially along sloughs (California Department of Fish and Wildlife 2013).

Natural community types in the study area that may provide habitat for Suisun Marsh aster are tidal brackish emergent wetland, tidal freshwater emergent wetland, and valley/foothill riparian (Figure 12-58). Occurrences of Suisun Marsh aster have been reported within or abutting CZ 1 (seven records), CZ 2 (seven records), CZ 3 (six records), CZ 4 (two records), CZ 5 (56 records), CZ 6 (36 records), CZ 7 (two records), CZ 10 (seven records), and CZ 11 (41 records) (California Department of Fish and Wildlife 2013). Threats to Suisun Marsh aster are erosion, marsh habitat alteration and loss, and possibly herbicide application (California Native Plant Society 2012q).

Suisun Thistle

Suisun thistle is federally listed as endangered and has a CRPR of 1B.1. It is known only from Suisun Marsh, where it grows in tidal marsh (Keil 2012a p. 286). Natural community types in the study area that may provide habitat for Suisun thistle are tidal brackish emergent wetland and managed wetland. Four CNDDB occurrences of Suisun thistle have been reported in CZ 11 (Figure 12-58) (California Department of Fish and Wildlife 2013). The threats to Suisun thistle are foot traffic and cattle tramping (California Native Plant Society 2012g).

Bolander's Water-Hemlock

Bolander's water-hemlock, which has a CRPR of 2.1, is known from occurrences along California's South Coast and Central Coast regions and from Suisun Marsh (Wetherwax and Constance 2012). It grows in coastal brackish and freshwater marshes (Wetherwax and Constance 2012; California Department of Fish and Wildlife 2013). Tidal brackish emergent wetland and tidal freshwater emergent wetland are natural community types in the study area that may provide habitat for Bolander's water-hemlock (Figure 12-58). Eight occurrences of Bolander's water-hemlock have been reported in CZ 1 (one record), CZ 5 (two records), CZ 10 (one record), and CZ 11 (four records) (California Department of Fish and Wildlife 2013). Threats to Bolander's water-hemlock are development, competition from nonnative plants, and hydrological alterations (California Native Plant Society 2012aa).

Inland Dune Plants

Hoover's Cryptantha

Hoover's cryptantha, which has a CRPR of 1A, was last seen in 1939 (California Native Plant Society 2012aaa). The historic range of Hoover's cryptantha was the northern and central San Joaquin Valley (Kelley et al. 2012 p. 463). It was collected while growing in coarse, sandy soils (Johnston 1937). Natural community types in the study area that may provide habitat for Hoover's cryptantha are inland dune scrub and grassland (Figure 12-59). Hoover's cryptantha was collected in 1908 in CZ 10 from sand hills east of Antioch, but the exact location is unknown and the species may have been extirpated because of development (California Department of Fish and Wildlife 2013).

Antioch Dunes Buckwheat

Antioch Dunes buckwheat, which has a CRPR of 1B.1, is known from a single occurrence in the Antioch Dunes in Contra Costa County (Reveal 2007). Habitat for Antioch Dunes buckwheat in the study area is limited to inland dune scrub (Figure 12-59). The occurrence of Antioch Dunes buckwheat is located in CZ 10 (California Department of Fish and Wildlife 2013). A potential threat to Antioch Dunes buckwheat is competition from nonnative plants (California Native Plant Society 2012dd).

Mt. Diablo Buckwheat

Mt. Diablo buckwheat, which has a CRPR of 1B.1, was historically known from Alameda, Contra Costa, and Solano Counties and was recently rediscovered on Mt. Diablo (California Department of Fish and Wildlife 2013; California Native Plant Society 2012ee). Potential habitat for Mt. Diablo buckwheat in the study area consists of grassland and inland dune scrub. Two occurrences of Mt. Diablo buckwheat have been reported within CZ 10 and CZ 11 (Figure 12-59) (California Department of Fish and Wildlife 2013). The primary threat to Mt. Diablo buckwheat has been habitat loss, and the remaining population is potentially threatened by trampling and competition from nonnative plant (California Native Plant Society 2012ee).

Contra Costa Wallflower

Contra Costa wallflower, is federally and state-listed as endangered and has a CRPR of 1B.1. Contra Costa wallflower is known only from three occurrences on the Antioch Dunes in Contra Costa County (California Department of Fish and Wildlife 2013), which fall within CZ 10 (Figure 12-59). Habitat for Contra Costa wallflower in the study area is restricted to inland dune scrub. Threats to Contra Costa wallflower are agricultural conversion, industrial development, mining, and competition from nonnative plants (California Native Plant Society 2012ff).

Antioch Dunes Evening-Primrose

Antioch Dunes evening-primrose is federally and state-listed as endangered and has a CRPR of 1B.1. Antioch Dunes evening-primrose is endemic to the Antioch Dunes in Contra Costa County, although it has been introduced at several transplantation sites (California Department of Fish and Wildlife 2013). Potential habitat for Antioch Dunes evening-primrose in the study area is restricted to inland dune scrub. The native occurrences of Antioch Dunes evening-primrose in the study area are located in CZ 10 (Figure 12-59). Three transplant sites are located in CZ 5 (California Department of Fish and Wildlife 2013). Threats to Antioch Dunes evening-primrose are agriculture, mining, competition from nonnative plants, and industrial development (California Native Plant Society 2012qq).

Nontidal Wetland Plants

Watershield

Watershield, which has a CRPR of 2.3, is known from scattered occurrences in northern and central California, although it has a world-wide distribution (Rosatti 2012). It is an aquatic species that occurs in ponds and slow streams (Rosatti 2012). Nontidal perennial aquatic and nontidal freshwater perennial emergent wetland are the natural community types in the study area that may provide habitat for watershield (Figure 12-60). Watershield occurrences have been reported within CZ 4 (one record) and CZ 5 (one record) and adjacent to the eastern boundary of CZ 6 (one record) (California Department of Fish and Wildlife 2013).

Bristly Sedge

Bristly sedge, which has a CRPR of 2.1, is known from scattered occurrences in California, primarily in Northern California; it also occurs in Oregon, Washington, and elsewhere in North America (Zika et al 2012 p. 1322; California Department of Fish and Wildlife 2013). It occurs in marshes at the margins of sloughs and lakes (California Department of Fish and Wildlife 2013). The natural community type in the study area that may provide habitat for bristly sedge is nontidal freshwater perennial emergent wetland (Figure 12-60). Occurrences of bristly sedge have been reported within

CZ 4 (nine records), CZ 5 (seven records), and CZ 6 (two records) (California Department of Fish and Wildlife 2013). Threats to bristly sedge are road maintenance, marsh drainage, agriculture, grazing, flooding for The Delta Wetlands Project, competition from nonnative plants, and control treatments for water hyacinth (California Department of Fish and Wildlife 2013; California Native Plant Society 2012w).

Woolly Rose-Mallow

Woolly rose-mallow, which has a CRPR of 1B.2, is known from scattered occurrences in the Cascade Range foothills, Sacramento Valley and the Delta (Hill 2012b). It grows in freshwater marsh along river banks and sloughs (Hill 2012b; California Department of Fish and Wildlife 2013). Nontidal freshwater perennial emergent wetland, tidal freshwater emergent wetland, and valley/foothill riparian are the natural community types in the study area that provide habitat for woolly rose-mallow (Figure 12-60). Woolly rose-mallow occurrences have been reported within and adjacent to CZ 1 (two records), CZ 3 (nine records), CZ 4 (10 records), CZ 5 (27 records), CZ 6 (49 records), CZ 7 (two records), CZ 8 (14 records), and CZ 9 (seven records) (California Department of Fish and Wildlife 2013). Threats to woolly rose-mallow are habitat disturbance, development, agriculture, recreational activities, weed control measures, erosion, and channelization of the Sacramento River and its tributaries (California Native Plant Society 2012kk).

Eel-Grass Pondweed

Eel-grass pondweed, which has a CRPR of 2.2, is known in California from scattered occurrences in the southern interior North Coast Ranges, the Central Valley, and the Modoc Plateau (Hellquist et al. 2012 p. 1501). It is a perennial aquatic species that grows in ponds, lakes and streams (Hellquist et al. 2012 p. 1501). Natural community types in the study area that provide potential habitat for eel-grass pondweed consist of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland. One occurrence of eel-grass pondweed has been reported in CZ 6 (Figure 12-60) (California Department of Fish and Wildlife 2013).

Sanford's Arrowhead

Sanford's arrowhead, which has a CRPR of 1B.2, is known from widely scattered locations in the North Coast, Klamath ranges, Cascade Range foothills, Central Valley, and South Coast (Turner et al. 2012). It occurs in freshwater ponds, marshes, streams and ditches with standing or slow-moving water (California Department of Fish and Wildlife 2013). Natural community types in the study area that provide potential habitat for Sanford's arrowhead are nontidal perennial aquatic and tidal and nontidal freshwater perennial emergent wetland (Figure 12-60). Occurrences of Sanford's arrowhead have been reported within or abutting CZ 2 (two records), CZ 3 (three records), CZ 4 (seven records), CZ 5 (10 records), and CZ 6 (one record) (California Department of Fish and Wildlife 2013). Threats to Sanford's arrowhead are grazing, development, recreational activities, competition with nonnative plants, road widening, and channel alteration (California Native Plant Society 2012ss).

Marsh Skullcap

Marsh skullcap, which has a CRPR of 2.2, occurs in the northern Sierra Nevada and Modoc Plateau (Olmstead 2012 p. 856). Disjunct populations have been reported from the Delta (California Department of Fish and Game 2013). It occurs in marshes, wet meadows, and other wetland communities, often on streambanks (Olmstead 2012 p. 856, California Department of Fish and

Wildlife 2013). Natural community types in the study area that provide potential habitat for marsh skullcap consist of tidal and nontidal freshwater perennial emergent wetland and valley/foothill riparian (Figure 12-60). Marsh skullcap occurrences have been reported in CZ 4 (one record), CZ 5 (two records), and CZ 6 (three records) (California Department of Fish and Wildlife 2013). Potential threats include hydrology alteration (California Native Plant Society 2012tt).

12.1.4 Invasive and Noxious Plant Species

This section discusses the applications of the terms *invasive plants* and *noxious weeds*, defines invasive plants for the purposes of this EIR/EIS chapter, provides general discussion on the effects of invasive plants on native species and natural communities, and identifies the invasive species that primarily affect the natural communities in the study area. The invasive species discussed below may affect more than one natural community. Information about the role of invasive plants as stressors to native fisheries is provided in Chapter 11, *Fish and Aquatic Resources*.

12.1.4.1 Definitions

The study area contains both aquatic and terrestrial plant species that have been designated as invasive plants and/or noxious weeds. Although these two descriptive terms are sometimes used interchangeably, it is important to note that there are implications associated with the use of each term. The term noxious weed is a designation used by government agencies, such as USDA and the California Department of Food and Agriculture (CDFA), for plant species that have been identified as pests by law or regulation. Invasive plants may be considered as such from a scientific perspective because of their ability to spread to areas that are far from their point of introduction (Richardson et al. 2000: 93). Plant species can also be identified as invasive from a political perspective through formal recognition by non-governmental organizations, such as the California Invasive Plant Council, which maintains a list of invasive plants that threaten California's wildlands. For the purpose of this EIR/EIS, invasive plants are species that have been identified as noxious weeds by USDA or CDFA, or as invasive plants by the California Invasive Plant Council (Cal-IPC) (California Invasive Plant Council 2006 and 2007; California Department of Food and Agriculture 2010; U.S. Department of Agriculture 2012).

12.1.4.2 General Effects on Native Species and Natural Communities

According to the California Department of Fish and Game's *California Aquatic Invasive Species Management Plan*, invasive species threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat (California Department of Fish and Game 2008a:ix). Invasive plants can change the invaded habitat by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry (California Invasive Plant Council 2006:1). Unlike the native plants they displace, many invasive plant species do not provide the food, shelter, or other habitat components on which many native fish and wildlife species depend. Invasive species also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (California Department of Fish and Game 2008a: ix, xi).

12.1.4.3 Invasive Plant Species in Natural Communities

The six counties that overlap with the study area contain more than 250 plants that have been identified as invasive by Cal-IPC (Calflora 2012). Invasive species are present in all of the natural communities in the study area. A discussion of the invasive species that primarily affect each natural community is provided below.

Tidal Perennial Aquatic

Invasive plants have exhibited a pronounced negative effect on the tidal perennial aquatic natural community and the special-status species that inhabit it. Water hyacinth and Brazilian waterweed are the two most well-studied aquatic invasive plant species in this natural community. Additional information about the role of aquatic invasive plants as stressors to native fisheries is provided in Chapter 11, *Fish and Aquatic Resources*.

Water hyacinth, a floating perennial, has been designated as a “C”[2] weed by CDFA and has a “High”[3] weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Water hyacinth is distributed nearly worldwide; it occurs throughout California but the highest density of reported occurrences is in the Delta (DiTomaso and Healy 2003: 52–54; California Invasive Plant Council 2012). Water hyacinth has a high growth rate in favorable conditions and forms dense, floating mats that clog waterways, displaces native flora and fauna, supports habitat for mosquitoes, and changes the amount of dissolved oxygen, pH, and temperature in affected waters (DiTomaso and Healy 2003: 52–54). Water hyacinth reproduces by seeds and vegetatively via stolons; dispersal occurs through water (e.g., flooding) and human activities (e.g., fishing and boating) or by sticking to the feathers or feet of waterfowl (DiTomaso and Healy 2003: 52–54).

Brazilian waterweed, a submerged perennial, has also been designated as a ‘C’ weed by CDFA and has a ‘High’ weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Brazilian waterweed occurs throughout the U.S.; most of the reported occurrences in California are in northern California, particularly in the Delta (California Invasive Plant Council 2012). Brazilian waterweed forms dense stands or subsurface mats that displace native flora and fauna, restrict water flow, increase flooding, clog pumps and boat propellers, and decrease recreational use of waterbodies (DiTomaso and Healy 2003: 96–105). Brazilian waterweed reproduces vegetatively by stolons and stem fragments; dispersal occurs through water, waterfowl, and human activities (e.g., fishing and boating) (DiTomaso and Healy 2003: 96–105).

South American spongeplant, a submerged aquatic perennial, is a more recently identified aquatic invasive plant threat. South American spongeplant, which was identified in the Delta in 2008, has been designated by CDFA as an “A” rated pest[4]. South American spongeplant has the capacity to

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[2] State-endorsed holding action and eradication only when found in a nursery; action related to halt the spread outside nurseries is at the discretion of the county agricultural commissioner.

[3] Species that have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure; their reproductive biology and other attributes facilitate moderate to high dispersal rates and establishment (California Invasive Plant Council 2006:3).

[4] An “A” rated invasive plant is a pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment.

rapidly disperse, cover large areas of open water, degrade fish and wildlife habitat, and interfere with pumping and irrigation systems. South American spongeplant reproduces vegetatively and by seeds; dispersal is facilitated by wind, currents, tidal action, waterfowl, and human activities (e.g., boating). (Anderson and Akers 2011: 4, 5).

Tidal Mudflat

There are no available data regarding the impacts of nonnative invasive species on this community. Where tidal mudflat exists within the valley/foothill riparian natural community, problematic plant species are likely to include giant reed and perennial pepperweed. Additionally, water hyacinth (discussed above) seedlings frequently establish in mud along shorelines with fluctuating water levels (DiTomaso and Healy 2003: 52–54).

Giant reed is a perennial grass that has been designated as a "B"[5] weed by CDFA and has a "High" weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Giant reed occurs in river valleys in central and northern California, in the San Francisco Bay area, and is spreading in the north coast (California Invasive Plant Council 2012). Giant reed, which can tolerate some salinity, forms dense monocultures that displace native flora, reduce wildlife habitat, amplify siltation and flooding, and increase the susceptibility of riparian areas to fire due to its high flammability. Giant reed reproduces vegetatively from rhizomes, rhizome fragments, and stem fragments (DiTomaso and Healy 2003: 254–262). Giant reed is spreading in tidal areas, where it frequently occurs on the backside of levees adjacent to sloughs (Vaghti and Keeler-Wolf 2004: 35).

Perennial pepperweed, a perennial, has also been designated as a "B" weed by CDFA and has a "High" weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Perennial pepperweed occurs throughout the western United States and is widespread in California (DiTomaso and Healy 2003: 171–175; California Invasive Plant Council 2012). Perennial pepperweed can tolerate saline and alkaline conditions and forms dense colonies that displace native flora (DiTomaso and Healy 2003: 171–175). Perennial pepperweed reproduces by seed and vegetatively by creeping roots and root fragments (DiTomaso and Healy 2003: 171–175).

Tidal Brackish Emergent Wetland

Invasive plants have exerted detrimental effects on the tidal brackish emergent wetland and the special-status species that occur there. The most well-studied invasive plant species in this natural community is perennial pepperweed (also discussed above). Other invasive plants that can negatively affect this natural community are fennel, giant reed (discussed above), pampas grass, barbgrass, and rabbitsfoot grass.

Vegetation mapping studies in Suisun Marsh and the San Francisco Estuary found that perennial pepperweed occurs most frequently and/or is spreading in tidal wetlands (Vaghti and Keeler-Wolf 2004:35; Boul et al. 2007: 20; Environmental Science Associates 2007: 6-2). The displacement by perennial pepperweed represents a substantial threat to the population sustainability of soft bird's-

[5] A "B" rated invasive plant is a pest of known economic or environmental detriment and, if present in California, it is of limited distribution. If found in California, they are subject to state endorsed holding action and eradication only to provide for containment (i.e., when in a nursery). At the discretion of the county agricultural commissioner they are subject to eradication, containment, suppression, control, or other holding action.

beak, a BDCP covered species that occurs in this natural community (Grewell 2005: 1, 61; U.S. Fish and Wildlife Service 2009d: 13). Perennial pepperweed is also considered a major threat to Suisun thistle, a BDCP covered species that occurs only in the salt and brackish marshes within Suisun Marsh (Fiedler et al. 2007: 211–212; U.S. Fish and Wildlife Service 2009c: 2, 11).

Fennel, a perennial herb, has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006). Fennel occurs throughout California, and dense local populations have been reported in the San Francisco Bay region, Santa Cruz Island, Palos Verdes peninsula, and Camp Pendleton (California Invasive Plant Council 2012). Fennel occurs in disturbed areas, particularly ruderal sites adjacent to fresh or brackish water and on the banks of creeks, estuaries, and bays (Klinger 2000: 198–202). Fennel alters the vegetative structure and composition of natural communities, possibly by outcompeting native species for resources (Klinger 2000: 198–202). Fennel spreads from root crowns and seeds that are dispersed by wildlife, humans (e.g., vehicular traffic, clothing), and water (Klinger 2000: 198–202; California Invasive Plant Council 2012).

Pampas grass, a perennial grass, has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006). Pampas grass is found in coastal areas, the Coast Ranges, the Central Valley, the Mojave Desert, and the western Traverse Ranges (California Invasive Plant Council 2012). Pampas grass, along with the nonnative genotype of common reed, typically colonizes along channels, in the marsh plain transition zone, and along the upland/marsh transition zone. Pampas grass reproduces via seeds that are dispersed by wind (California Invasive Plant Council 2012).

Additionally, nonnative barbgrass and rabbitsfoot grass threaten the sustainability of soft bird’s-beak by functioning as ineffective host plants that result in seed mortality (Grewell 2005: 1).

Tidal Freshwater Emergent Wetland

The primary invasive plants that affect the tidal freshwater emergent wetland natural community are perennial pepperweed and giant reed, which are discussed above.

Valley/Foothill Riparian

The susceptibility of riparian areas to invasion by invasive plants appears to be strongly determined by local landscape structure and disturbance regimes for a particular site (Planty-Tabacchi et al. 1996: 604, 605). In the study area, the primary invasive species that can negatively affect the valley/foothill riparian natural community are giant reed (discussed above), perennial pepperweed (also discussed above), and red sesbania. Perennial pepperweed can spread rapidly in riparian floodplain areas (Hogle et al. 2006: 8). Other invasive species that occur in this natural community are black locust, tamarisk (multiple species), and Himalayan blackberry.

Red sesbania has been designated as a “B” weed by CDFA and has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Red sesbania can form dense thickets that displace native flora and fauna (Platenkamp and Hunter 2003: 114). Red sesbania establishes in moist, open substrates in riparian areas, marshes, and the margins of ponds, canals, and ditches (DiTomaso and Healy 2003: 7). Thickets on channel banks, gravel bars, and instream islands may also cause a substantial increase in hydraulic roughness (i.e., flooding and erosion)(Platenkamp and Hunter 2003: 4, 5).

Nontidal Perennial Aquatic

The primary invasive plants in the nontidal perennial aquatic natural community are Brazilian waterweed (discussed above), Eurasian watermilfoil, and water hyacinth (discussed above).

Eurasian watermilfoil, a submersed aquatic perennial, has been designated as a "C" weed by CDFA and has a "High" weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Similar to Brazilian waterweed and water hyacinth, Eurasian watermilfoil forms thick mats at the water surface that displace native aquatic flora and fauna, shade aquatic habitat, detract from recreational use of waterways, and clog irrigation pipes and canals (San Francisco Estuary Institute 2003:11). Eurasian watermilfoil inhabits freshwater lakes, ponds, and slow-moving canals in northern and central California (California Invasive Plant Council 2012). Eurasian watermilfoil reproduces by rhizomes, stem fragments, and axillary buds (DiTomaso and Healy 2003: 93). The dispersal of stem fragments is facilitated by waterfowl, mechanical harvesting, boating, and dumping aquarium or pond contents (DiTomaso and Healy 2003: 93).

Nontidal Freshwater Perennial Emergent Wetland

The primary invasive plants that affect the nontidal freshwater perennial emergent wetland natural community are Brazilian waterweed, Eurasian watermilfoil, and water hyacinth, which are discussed above and which form dense mats that clog waterways and displace native flora and fauna.

Alkali Seasonal Wetland Complex

The primary invasive plants that affect or could affect the alkali seasonal wetland complex natural community in the study area are Italian ryegrass and perennial pepperweed (discussed above).

Italian ryegrass has a "Moderate"[6] weed rating from Cal-IPC and is found throughout California (California Invasive Plant Council 2006; California Invasive Plant Council 2012). Italian ryegrass forms dense stands in areas adjacent to alkali sinks and appears to have ecotypes that are more tolerant of the severe conditions in inundated alkali sinks, which could threaten native alkali species (Dawson et al. 2007: 328, 333). As previously mentioned, perennial pepperweed can tolerate alkaline conditions (DiTomaso and Healy 2003: 171–175). There are no data describing the effects of invasive plant species on wildlife species in this natural community.

Vernal Pool Complex

The invasive plants in the vernal pool complex invade the pool interiors or the adjacent grasslands.

Waxy mannagrass is a primary invasive plant in pool interiors. Waxy mannagrass occurs throughout the Central Valley from Shasta County to Fresno County and has a "Moderate" weed rating from Cal-IPC (California Invasive Plant Council 2012). The invasion of vernal pools by waxy mannagrass is

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[6] Species that have substantial and apparent (but typically not severe) ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread (California Invasive Plant Council 2006:3).

widespread and was undetected until relatively recently because of taxonomic confusion with a native species (Gerlach et al. 2009: 92).

The primary invaders that have a substantial known or potential effect on grasslands in vernal pool complexes are perennial pepperweed (also discussed above), yellow starthistle, medusahead, purple starthistle, barb goatgrass, Italian ryegrass, and Italian thistle (Swiecki and Bernhardt 2002: 34; Witham 2003: 18; Witham 2006: 41–46; Hopkinson et al. 2008: 20–24).

Yellow starthistle, an annual herb, has been designated as a “C” weed by CDFA and has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Yellow starthistle displaces native flora and fauna, depletes soil moisture in annual grasslands, and is toxic to horses (DiTomaso and Gerlach 2000: 103). Yellow starthistle is widely distributed throughout California and reproduces from seeds; a large individual can generate almost 75,000 seeds that are primarily transported by human activities (DiTomaso and Gerlach 2000: 103; California Invasive Plant Council 2012).

Medusahead, an annual grass, has been designated as a “C” weed by CDFA and has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Medusahead is distributed throughout northwestern California and reproduces through seeds (California Invasive Plant Council 2012). Medusahead negatively affects natural communities by outcompeting native flora, forming a layer of thatch that thwarts the germination and survival of native plants, increasing the risk of fire, tying up nutrients, and being palatable to livestock and native fauna wildlife only at the onset of the growing season (Kan and Pollack 2000: 310, 311).

Purple starthistle, an annual, biennial, or perennial herb, has been designated as a “B” weed by CDFA and has a “Moderate” weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). The highest density of purple starthistle occurrences is in the northern and central Coast Ranges (California Invasive Plant Council 2012). Purple starthistle reproduces by seeds, frequently displaces desired native vegetation (Randall 2000: 96; California Invasive Plant Council 2012).

Barb goatgrass, an annual grass, has been designated as a “B” weed by CDFA and has a “High” weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). The highest density of barb goatgrass occurrences is in the Sierra foothill grasslands of central California (California Invasive Plant Council 2012). Barb goat grass is unpalatable to cattle and can wound livestock by embedding in their mouths or eyes (California Invasive Plant Council 2012). Barb goatgrass reproduces by seed.

Italian thistle, an annual or biennial herb grass, has been designated as a “C” weed by CDFA and has a “Limited”[7] weed rating from Cal-IPC (California Invasive Plant Council 2006; California Department of Food and Agriculture 2010). Italian thistle has been reported throughout the Central Valley, Sierra foothill grasslands, and along the coast (California Invasive Plant Council 2012). Italian thistle reproduces by seed, displaces native flora, is generally avoided as forage because of the

[7] Species that are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic (California Invasive Plant Council 2006:3).

spines, and has the potential to spread grass fires to tree canopies in oak savannah (Bossard and Lichti 2000:88).

Managed Wetland

The primary invasive species that affect managed wetlands are comparable to those discussed above for tidal brackish emergent wetland and tidal freshwater emergent wetland natural communities.

Other Natural Seasonal Wetland

The invasive species that primarily affect the other natural seasonal wetland community are waxy mannagrass, Italian ryegrass, and perennial pepperweed, which are discussed above (Hogle et al. 2006; Dawson et al. 2007; Gerlach et al. 2009).

Grassland

The primary invasive species that affect the grassland natural community in the study area are comparable to those that occur in grassland in vernal pool complexes (discussed above).

Inland Dune Scrub

The invasive species found in the inland dune scrub in the study area are typically dominated by ripgut brome, yellow starthistle, telegraph weed, wild lettuce, and wild radish. Ripgut brome, yellow starthistle (also discussed above), vetch (multiple species), and Russian thistle are the invasive plants of primary concern at Antioch Dunes NWR. The spread of invasive plants is the major threat to the federally listed Antioch Dunes evening primrose and Contra Costa wallflower because invasive plants outcompete native vegetation for resources (e.g., sunlight, water) and stabilize the remaining dune areas; the Antioch Dunes evening primrose needs regular disturbance for germination. Additionally, the spread of ripgut brome and yellow starthistle on the refuge reduces the amount of buckwheat available to the federally listed Lange's metalmark butterfly. (U.S. Fish and Wildlife Service 2001:24, 28, 31, 42).

Ripgut brome, an annual grass, has a "Moderate" rating from Cal-IPC and is distributed throughout California (California Invasive Plant Council 2006 and 2007; California Invasive Plant Council 2012). Ripgut brome displaces native vegetation and increases wildfire frequency because of its flammability during the dry season (California Invasive Plant Council 2012). Ripgut brome spreads from seeds that are dispersed through the movement of water and soil or carried by animals, people, and equipment (California Invasive Plant Council 2012).

Russian thistle, an annual herb, has been designated as a "C" weed by CDFA and has a "Limited" weed rating from Cal-IPC (California Invasive Plant Council 2006 and 2007; California Department of Food and Agriculture 2010). Russian thistle occurs throughout California and can be a fire hazard, impede traffic, and act as the host plant for the beet leaf-hopper, an agricultural pest (California Invasive Plant Council 2012). Russian thistle spreads via seeds.

Cultivated Lands

Cultivated lands in the study area consist primarily of crops that are intermixed with small areas of natural habitat, such as riparian corridors or wetlands. Past and ongoing ground disturbance (e.g., tillage and irrigation) associated with cultivated lands facilitate the establishment of invasive plants, which colonize the perimeter of active agricultural fields and rapidly germinate in fallow fields. Maintenance activities, such as herbicide application and regular cultivation, are implemented in active fields to reduce the effects of invasive plants. Invasive plants that are commonly found in cultivated lands are wild radish, bindweed, fennel, field mustard, and Bermuda grass.

12.2 Regulatory Setting

Specific federal, state and local laws, regulations, policies, executive orders and plans that affect, or have the potential to affect how terrestrial biological resources are impacted, used or managed during implementation of the action alternatives are discussed in this section.

12.2.1 Federal Plans, Policies, Regulations, and Executive Orders

12.2.1.1 Sections 404 and 401 of the Clean Water Act

Section 404 of the CWA requires a project applicant to obtain a permit from USACE before engaging in any activity that involves any discharge of dredged or fill material into waters of the United States, including wetlands. Section 401 of the CWA is administered by state agencies and is discussed below under state plans, policies, and regulations. Waters of the United States is defined to encompass navigable waters of the United States; interstate waters; all other waters where their use, degradation, or destruction could affect interstate or foreign commerce; tributaries to any of these waters; and wetlands that meet any of these criteria or are adjacent to any of these waters or their tributaries. Wetlands are defined under Section 404 as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands must meet three delineation criteria to be subject to jurisdiction by USACE.

- They support hydrophytic vegetation (i.e., plants that grow in saturated soil).
- They have hydric soil types (i.e., soils that are wet or moist enough to develop anaerobic conditions).
- They have wetland hydrology.

USACE would likely have jurisdiction under Section 404 over actions associated with some elements of the action alternatives Because the USACE jurisdiction and scope would not include an entire action alternative, USACE would likely make multiple permit decisions over the course of implementing the various elements of an action alternative (regional general permits or individual permits). As an example, it is expected that construction implementation of the water conveyance facility would require permits under the CWA.

In 2008, USACE and the EPA issued national regulations, known as the *Mitigation Rule* governing compensatory mitigation for activities authorized by permits issued by USACE (33 Code of Federal Regulations [CFR] Sections 325, 332), and in 2015, the USACE South Pacific Division issued *Regional Compensatory Mitigation and Monitoring Guidelines* (Final January 12, 2015) (Division Guidelines) to supplement the national Mitigation Rule. Compensatory mitigation under the Mitigation Rule and Division Guidelines fulfill the long standing national goal of replacing the loss of wetland and other aquatic resource acreages and functions, known as the “no net loss” goal in theNational Wetlands

Mitigation Action Plan (U.S. Environmental Protection Agency and U.S. Army Corps of Engineers 2002). To achieve the no net loss goal, USACE and EPA have concluded that, where appropriate and practicable, compensatory mitigation "should provide, at a minimum one for one functional replacement (i.e., no net loss of values), with an adequate margin of safety." The long-term objective of the no net loss policy is to increase wetland acreages and functions nationally.

The Mitigation Rule defines compensatory mitigation as 1) restoring existing wetlands or reestablishing former wetlands; 2) creating new wetlands in upland areas; 3) enhancing the functional values of degraded wetlands; and 4) preserving wetlands restoration aquatic resources. Restoration is generally the preferable form of compensatory mitigation because the likelihood of success is greater while the impacts to potentially ecologically important uplands are less, as compared to creation. Moreover, the potential gains in terms of aquatic resources functions are oftentimes greater with restoration as compared to enhancement and preservation (33 CFR Section 332.3(a)(2)). The Mitigation Rule and Division Guidelines stress the benefits of a watershed approach to compensatory mitigation, and compensatory mitigation generally should be located in the same watershed as the impact site, and where it is most likely to successfully replace lost functions and services (33 CFR Section 332.3; Division Guidelines, Section 3.2)

Sections 404 and 401 of the CWA are relevant to terrestrial biological resources in the study area because wetlands and waters of the United States provide habitat to both special-status and common terrestrial species.

12.2.1.2 Endangered Species Act

Pursuant to the federal ESA, USFWS and NMFS have authority over projects that may result in take of a species listed as threatened or endangered under the act. *Take* is defined under the ESA, in part, as killing, harming, or harassing. Under federal regulations, take is further defined to include habitat modification or degradation that results, or is reasonably expected to result, in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. If a likelihood exists that a project would result in take of a federally listed species, either an incidental take permit, under Section 10(a) of the ESA, or a federal interagency consultation, under Section 7 of the ESA, is required. Section 7 of the federal ESA also provides the USFWS authority to regulate the adverse modification of critical habitat for listed species, when the action requires federal funding or approval. The potential for federally listed wildlife and plant species to occur in the study area is discussed above in Section 12.1.3, *Special-Status Species*. A discussion of critical habitat in the study area is presented in Section 12.1.3.1.

12.2.1.3 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) ensures that fish and wildlife receive equal consideration with water resources development during planning and construction of federal water projects by requiring that the federal agencies consult with USFWS and the state wildlife resources agency before the waters of any stream or other body of water are impounded, diverted, deepened or otherwise controlled or modified. The FWCA requires that the views of USFWS and the state agency be considered when evaluating impacts and determining mitigation needs. NEPA regulations further require that an EIS meet the consultation requirements of the FWCA. Therefore, the FWCA consultation requirements for the action alternatives are being satisfied through the EIR/EIS process. Terrestrial biological resources are a principal focus of the FWCA coordination occurring for the action alternative conservation planning process.

12.2.1.4 CALFED Bay-Delta Program

Federal and state agencies developed a regulatory and management strategy to implement a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The federal agencies involved in the CALFED Bay-Delta Program are the U.S. Bureau of Reclamation (Reclamation), USFWS, NMFS, USACE, and the U.S. Environmental Protection Agency (EPA). The state agencies involved in the program are CDFW, DWR, and the State Water Resources Control Board (State Water Board) (CALFED Bay-Delta Program 2000).

In August of 2000, the CALFED Record of Decision was signed and included eleven program elements to improve the health and sustainability of the Bay-Delta ecosystem so that it may become a more reliable source of drinking water and irrigation water for 25 million Californians and 7.5 million acres of agricultural land. Program goals, milestones, and actions are outlined in the CALFED Multi-Species Conservation Strategy. CDFW and its federal partner agencies are completing a Conservation Strategy for Stage 2 of ERP (through 2030). Although the CALFED ROD remains in effect and many of the state, federal and local projects begun under CALFED continue, future direction and administration must be coordinated through the Delta Stewardship Council and be consistent with the pending Delta Plan, which is discussed below in State Plans, Policies, and Regulations.

The CALFED program has four objectives.

- Provide optimal water quality.
- Improve and increase aquatic and terrestrial habitats, and improve ecological functions in the Bay-Delta Estuary to support sustainable populations of diverse plant and animal species.
- Reduce shortages between water supplies and current and projected demands on the system.
- Reduce the risk of failure of Delta levees that protect land use and associated economic activities, water supply, and other infrastructure and ecosystems.

12.2.1.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) domestically implements a series of international treaties that provide for migratory bird protection. The MBTA authorizes the Secretary of the Interior to regulate the taking of migratory birds. The act further provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird…" (Title 16, USC, Section 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA can be found in the March 1, 2010 Federal Register (75 FR 9281). This list contains several hundred species including essentially all native birds. Permits for take of nongame migratory birds can be issued only for specific activities, such as scientific collecting, rehabilitation, propagation, education, taxidermy, and protection of human health and safety and of personal property. USFWS publishes a list of birds of conservation concern (BCC) to identify migratory nongame birds that are likely to become candidates for listing under ESA without additional conservation actions. The BCC list is intended to stimulate coordinated and collaborative conservation efforts among federal, state, tribal, and private parties. Implementation of the action alternatives has the potential to both positively and negatively affect bird species protected under the MBTA.

12.2.1.6 Rivers and Harbors Act

Under Section 10 of the Rivers and Harbors Act of 1899, the construction of structures in, over, or under, excavation of material from, or deposition of material into navigable waters are regulated by USACE. Navigable waters of the United States are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark or those that are currently used, have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A Letter of Permission or permit from USACE is required prior to any work begun within navigable waters. Numerous terrestrial species that are addressed in this EIR/EIS require navigable waters for a part of their habitat.

12.2.1.7 Comprehensive Conservation Plans for National Wildlife Refuges

USFWS is directed to develop comprehensive conservation plans (CCP) to guide the management and resource use for each refuge of the National Wildlife Refuge System under requirements of the National Wildlife Refuge Improvement Act of 1997. Refuge planning policy also directs the process and development of CCPs. A CCP provides a description of the desired future conditions and long-range guidance necessary for meeting refuge purposes. It also guides management decisions and sets forth strategies for achieving refuge goals and objectives within a 15-year timeframe. The USFWS adopted a CCP for Stones Lakes NWR in 2007. Many of the species analyzed in the EIR/EIS are affected by the management practices of the Stone Lakes NWR.

12.2.1.8 North American Waterfowl Management Plan and Central Valley Joint Venture

In 1986, the United States and Canada signed the North American Waterfowl Management Plan (NAWMP). It provides a broad framework for waterfowl management and includes recommendations for wetland and upland habitat protection, restoration, and enhancement. Implementing the NAWMP is the responsibility of designated joint ventures. The Central Valley Habitat Joint Venture formally organized in 1988 as one of the original six priority joint ventures formed under the NAWMP. Renamed the Central Valley Joint Venture in 2004, the Management Board now oversees the membership of 21 federal and state agencies and conservation organizations. The organization's 2006 Implementation Plan broadens the scope of conservation activities to include objectives for shorebirds, waterbirds, and riparian songbirds. The management objectives of the NAWMP affect several of the bird species analyzed in the EIR/EIS.

12.2.1.9 Federal Noxious Weed Act and Code of Federal Regulations (Title 7, Part 360)

These laws and regulations are primarily concerned with the introduction of federally designated noxious weed plants or seeds across the United States' international borders. The Federal Noxious Weed Act (7 USC Sections 2801–2813) also regulates the interstate movement of designated noxious weeds under USDA's permit system. This act would be a factor in any decisions to import construction materials and equipment as part of CM1, including aggregate, from out-of-state or out-of-country.

12.2.1.10 Executive Order 11990: Protection of Wetlands

Executive Order 11990 (May 24, 1977) established the protection of wetlands and riparian systems as the official policy of the federal government. The executive order requires all federal agencies to consider wetland protection as an important part of their policies, take action to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands. Most of the terrestrial habitats considered in this chapter are wetlands or are immediately adjacent to wetlands.

12.2.1.11 Executive Order 13112: Invasive Species

Executive Order 13112 (February 3, 1999) directs all federal agencies to prevent and control the introduction and spread of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their effects to economic, ecological, and human health. The executive order was intended to build upon existing laws, such as NEPA, the Nonindigenous Aquatic Nuisance Prevention and Control Act, the Lacey Act, the Plant Pest Act, the Federal Noxious Weed Act, and the ESA. The executive order established a national Invasive Species Council composed of federal agencies and departments, as well as a supporting Invasive Species Advisory Committee composed of state, local, and private entities. The council and advisory committee oversee and facilitate implementation of the executive order, including preparation of the National Invasive Species Management Plan. Federal activities addressing invasive aquatic species are now coordinated through this council and through the National Aquatic Nuisance Species Task Force. Federal agencies with any decision-making authority over the action alternatives and its implementation must ensure that construction and restoration actions do not result in the spread of invasive species into terrestrial habitats.

12.2.1.12 Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 (January 10, 2001) directs federal agencies that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a memorandum of understanding with USFWS to promote the conservation of migratory bird populations. The various memoranda of understanding include implementation actions and reporting procedures for each agency's formal planning process, such as preparation of resource management plans. The BDCP is a resource management plan with the potential to affect migratory birds and their habitat in the Plan Area.

12.2.1.13 Executive Order 13443: Facilitation of Hunting Heritage and Wildlife Conservation

The purpose of Executive Order 13443 (August 16, 2007) is to direct federal agencies that maintain programs and activities having a measurable effect on public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Proposed actions have the potential to affect game species in the Plan Area, particularly waterfowl and upland game birds.

12.2.2 State Plans, Policies, and Regulations

12.2.2.1 California Endangered Species Act

CESA (California Fish and Game Code Sections 2050–2116) states that all native species or subspecies of a fish, amphibian, reptile, mammal, or plant and their habitats that are threatened with extinction and those experiencing a significant decline that, if not halted, would lead to a threatened or endangered designation will be protected or preserved.

Under Section 2081 of the Fish and Game Code, a permit from CDFW is required for projects that could result in the take of a species that is state-listed as threatened or endangered. Under CESA, *take* of a species means hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill (California Fish and Game Code, Section 86). The definition does not include *harm* or *harass*, as the definition of take under ESA does. As a result, the threshold for take under CESA is higher than that under ESA. For example, habitat modification is not necessarily considered take under CESA. The potential for state-listed wildlife and plant species to occur in areas that could be affected by the action alternatives is discussed above in Special-Status Species. The new subalternatives (4A, 2D, and 5A) would comply with CESA through Section 2081.

12.2.2.2 Fully Protected Species

Fish and Game Code Sections 3511, 3513, 4700, and 5050 pertain to fully protected wildlife species (birds in Sections 3511 and 3513, mammals in Section 4700, and reptiles and amphibians in Section 5050) and strictly prohibit the take of these species. CDFW cannot issue a take permit for fully protected species, except under narrow conditions for scientific research or the protection of livestock, or if an NCCP has been adopted. The action alternatives have the potential to affect seven fully protected species (six birds and the salt marsh harvest mouse).

12.2.2.3 California Native Plant Protection Act

Fish and Game Code Sections 1900–1913 codify the Native Plant Protection Act of 1977 (NPPA), which is intended to preserve, protect, and enhance endangered or rare native plants in the state. Under Section 1901, a species is *endangered* when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species is *rare* when, although not threatened with immediate extinction, it exists in such small numbers throughout its range that it may become endangered if its present environment worsens. The NPPA gave the California Fish and Game Commission the power to designate native plants as endangered or rare, and the act protected endangered and rare plants from take. According to CDFW, a CESA Section 2081 permit for incidental take of listed threatened and endangered plants from all activities is required, except for activities specifically authorized by the NPPA. Because rare plants are not included under CESA, mitigation measures for impacts on rare plants are specified in a formal agreement between CDFW and the project proponent.

CNPS has developed and maintains lists of plants of special concern in California, as described above under Special-Status Species. CNPS-listed species have no formal legal protection, but the values and importance of these lists are widely recognized. Plants listed on CNPS Lists 1A, 1B, and 2 meet the definitions of endangered under Fish and Game Code Section 1901 and may qualify for state listing. Therefore, for purposes of this analysis, they are considered rare plants pursuant to Section 15380 of CEQA.

12.2.2.4 Section 1600 of the California Fish and Game Code

Sections 1600–1603 of the Fish and Game Code state that it is unlawful for any person or agency to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources, or to use any material from the streambeds, without first notifying CDFW. A Lake and Streambed Alteration Agreement must be obtained if effects are expected to occur. The regulatory definition of a stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks, and that supports wildlife, fish, or other aquatic life. This definition includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation. CDFW's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. The information contained in this chapter could be used in future applications for streambed alteration agreements associated with the construction elements of the action alternative conservation measures or Environmental Commitments.

12.2.2.5 Sections of the California Fish and Game Code Pertaining to Invasive Species

CDFW is one of the primary state agencies responsible for state efforts to prevent the introduction of new invasive species, detect and respond to introductions when they occur, and manage and prevent the spread of established invasive species. This responsibility is derived from California Fish and Game Code Sections 2116–2127, 2150–2157, 2185–2195, 2270-2272, 2300–2302, 6400–6403, and 15000 et seq. These sections relate to the importation, transfer, and possession of live wild animals, aquatic plants, and fish into the state; the placement of live aquatic animals and plants in state waters; and the operation of aquaculture industries. The various construction elements of the action alternatives have the potential to introduce or spread invasive species into natural habitats of the species considered in this chapter.

12.2.2.6 Natural Communities Conservation Planning Act

Fish and Game Code Sections 2800–2835 detail the state's policies on the conservation, protection, restoration, and enhancement of the state's natural resources and ecosystems. The intent of the legislation is to provide for conservation planning as an officially recognized policy that can be used as a tool to eliminate conflicts between the protection of natural resources and the need for growth and development. In addition, the legislation promotes conservation planning as a means of coordination and cooperation among private interests, agencies, and landowners, and as a mechanism for multispecies and multihabitat management and conservation. One conservation plan adopted pursuant to the NCCPA falls within the study area (the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, which is discussed below) and at least two other NCCPs are in the planning stages. The BDCP alternatives were prepared in compliance with the NCCPA. The development of NCCPs is an alternative to obtaining take authorization under Section 2081 of the Fish and Game Code. The new subalternatives (4A, 2D, and 5A) are not being prepared in compliance with the NCCP.

12.2.2.7 Porter-Cologne Water Quality Control Act

Under the Porter-Cologne Act definition, *waters of the state* are "any surface water or groundwater, including saline waters, within the boundaries of the state." Although all waters of the United States that are within the borders of California are also waters of the state, the reverse is not true.

Therefore, California retains authority to regulate discharges of waste into any waters of the state, regardless of whether USACE has concurrent jurisdiction under CWA Section 404, and defines *discharges to receiving waters* more broadly than the CWA does.

Waters of the state fall under the jurisdiction of the nine RWQCBs. Under this act, each RWQCB must prepare and periodically update water quality control basin plans. Each basin plan sets forth water quality standards for surface water and groundwater, as well as actions to control nonpoint and point sources of pollution. California Water Code Section 13260 requires any person discharging waste, or proposing to discharge waste, in any region that could affect the waters of the state to file a report of discharge (an application for waste discharge requirements [WDRs]) with the applicable RWQCB. California Water Code Section 13050 authorizes the State Water Board and the affiliated RWQCB to regulate biological pollutants. Aquatic invasive plants discharged to receiving waters are an example of this kind of pollutant. Construction and restoration activities associated with the action alternatives that may discharge wastes into the waters of the state must meet the discharge control requirements of the Porter-Cologne Act.

12.2.2.8 California Food and Agriculture Code

More than 30 different sections of the California Food and Agriculture Code pertain to the state's mandate to prevent the introduction and spread of injurious animal pests, plant diseases, and noxious weeds. Most of these statutes and their associated regulations (Title 3 of the California Code of Regulations [CCR]) are contained in Food and Agriculture Code Sections 403, 461, 5004, 5021–5027, 5301–5310, 5321–5323, 5401–5404, 5421, 5430–5432, 5434, 5761–5763, 7201, 7206–7207, and 7501–7502. These codes describe procedures and regulations concerning: plant quarantines, regulation of noxious weed seed, emergency pest eradications to protect agriculture, pests as public nuisances, vectors of infestation and infection, the sale, transport and propagation of noxious weeds, and the protection of native species and forests from weeds. CDFA enforces most of these statutes and their relevant regulations (California Department of Fish and Game 2008a). Construction and restoration activities associated with the action alternatives must meet the pest and vector control requirements of this code.

12.2.2.9 Harbors and Navigation Code

Article 2, Section 64 of the Harbors and Navigation Code designates the California Department of Boating and Waterways (CDBW) as the lead state agency to cooperate with other state, local, and federal agencies to control water hyacinth, Brazilian waterweed, and South American spongeplant in the Delta, its tributaries, and Suisun Marsh. Any action alternative-related activities to restore or modify Plan Area habitats must be undertaken in cooperation with CDBW to avoid the spread of these invasive plants.

12.2.2.10 Delta Protection Act of 1992

The Delta Protection Act of 1992 (Water Code Section 12220) established the Delta Protection Commission (DPC) to prepare and oversee a comprehensive Land Use and Resources Management Plan (LURMP) for the Delta Primary Zone. The Primary Zone consists of the lands in the Delta's central portion that were not within either the urban limit line or sphere of influence line of any local government's general plan or studies as of January 1, 1992. The Primary Zone encompasses 487,625 acres (approximately 66% of the statutory Delta) of varied land uses, waterways, and levees in parts of Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. The remaining areas of the legal Delta are designated as the Secondary Zone and are not under Commission land use jurisdiction (Delta Protection Commission 2010).

The DPC in 1995 adopted a LURMP for the Primary Zone to address land uses and resource management—with a particular emphasis on agriculture, which was designated by the Delta Protection Act as the primary use of this zone—wildlife habitat, and recreation. In 2000, the LURMP policies were adopted as regulations (Title 14, CCR, Chapter 3, *Regulations Governing Land Use and Resources Management in the Delta*); the plan was revised and reprinted in 2002.

The Delta Protection Act was amended in 2009 by the Sacramento-San Joaquin Delta Reform Act (SB 1 X7), which modified the DPC's composition and responsibilities. The DPC has since adopted an updated LURMP, which became effective on November 6, 2010. It contains policies to protect the Delta's unique character, expand public access and recreation, and locate new transmission lines and utilities within existing corridors to minimize impacts (Delta Protection Commission 2010). These policies are required to be incorporated into the local general plans of the counties with jurisdiction over portions of the Primary Zone. Local planning decisions may be appealed to DPC for a determination of consistency with the LURMP. Nothing in the law makes the LURMP binding on state agencies such as DWR as a project proponent. For a more detailed discussion of the LURMP, please see Chapter 13, *Land Use*.

12.2.2.11 Delta Vision Strategic Plan

The Delta Vision Blue Ribbon Task Force (Task Force) was created in 2006 by Executive Order S-17-06. The Task Force was charged with creating strategies to repair ecological damage to the Delta and methods for sustaining the Delta in future decades. The Delta Vision Strategic Plan (Strategic Plan) was approved and adopted unanimously by the Task Force on October 17, 2008 (Governor's Delta Vision Blue Ribbon Task Force 2008). The Strategic Plan is intended to ensure a reliable water supply for the two-thirds of California's population that depends, in whole or in part, on water from the Delta. The vision for the Delta is based on two interdependent goals: restore the Delta, and create a more reliable water supply.

The Task Force determined that creation of a reliable water delivery system could help to restore the ecosystem. It recommended that the state analyze a two-channel approach to water delivery, improving the Delta's existing conveyance channel and adding a second channel to carry water to export pumps. The Task Force also recommended increasing storage capacity and modifying operations, which would improve water supply reliability.

The Task Force further recommended reduced dependence on water from the Delta in order to cut the risk of a failed Delta conveyance system and lessen risks to the ecosystem. The Strategic Plan acknowledged that a revitalized Delta ecosystem would require reduced diversions at critical times (Governor's Delta Vision Blue Ribbon Task Force 2008). The Task Force formulated seven goals, including establishing a new governing structure, enhancing the Delta's cultural, recreational, and agricultural values, and promoting statewide water conservation.

12.2.2.12 Delta Stewardship Council

Signed by the governor in 2009, the Sacramento-San Joaquin Delta Reform Act (Water Code Section 85000 et seq.) created a new Delta Stewardship Council (DSC) and gave this body broad oversight of Delta planning and resource management. The DSC has been tasked with developing and implementing a long-term, comprehensive management plan (Delta Plan) that emphasizes the coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem" (Water Code Section 85300(a)) as the foundation for state decisions regarding Delta management.

Among other things, the Reform Act contains three specific mandates for the DSC.

- Include measures in the Delta Plan to promote statewide water conservation, water use efficiency, and sustainable use of water, as well as improvements to water conveyance/storage and operation of both to achieve the coequal goals.
- Include measures in the Delta Plan that attempt to reduce risks to people, property, and state interests in the Delta by promoting effective emergency preparedness, appropriate land uses, and strategic levee investments.
- Determine whether state or local agency projects are consistent with the Delta Plan.

In addition, the Reform Act requires the Delta Plan to cover five topic areas and goals.

- Increased water supply reliability
- Restoration of the Delta ecosystem
- Improved water quality
- Reduced risks of flooding in the Delta
- Protection and enhancement of the Delta

Although it had a deadline of December 31, 2011 to adopt a Delta Plan, the DSC continued preparing the plan until the final Delta Plan was adopted on May 16, 2013. Following adoption of the Delta Plan, covered actions are required to be consistent with the Delta Plan. Additionally, the DSC must incorporate the BDCP into the approved Delta Plan if the BDCP meets certain requirements. Specifically, CDFW must approve the BDCP as an NCCP, and CDFW must determine that the BDCP complies with Water Code Section 85320 and that the BDCP has been approved under the ESA as a Habitat Conservation Plan. Delta Reform Act compliance for the non-HCP alternatives 4A, 2D, and 5A, involving construction and operation of water intakes in the north Delta and associated conveyance facilities would, be achieved through either the Delta Plan Consistency certification process or through a possible future amendment to the Delta Plan. Appendix 3J, *Alternative 4A (Proposed Project) Compliance with the 2009 Delta Reform Act*, discusses an approach that may be considered for Alternative 4A to meet the Delta Plan Consistency requirements.

12.2.2.13 California Aquatic Invasive Species Management Plan

The California Aquatic Invasive Species Management Plan (CAISMP) provides a comprehensive, coordinated effort between state agencies and other entities to prevent new invasions, minimize impacts from established aquatic invasive species, and establish priorities for action statewide. CAISMP identifies eight primary objectives and actions needed to minimize the harmful effects of aquatic invasive species on ecosystems, the economy, and human health. An example of the implementation of CAISMP's long-term control and management objective in the Delta is CDBW's Aquatic Weed Control Program, which primarily focuses on the control of Brazilian waterweed and water hyacinth. These control practices must be taken into consideration in developing restoration actions for the terrestrial and aquatic species.

12.2.2.14 California Wetlands Conservation Policy

The goals of the California Wetlands Conservation Policy, adopted in 1993 (Executive Order W-59-93), are "to ensure no overall net loss, and achieve a long-term net gain in the quantity, quality, and permanence of wetlands acreage and values in California, in a manner that fosters creativity, stewardship, and respect for private property;" to reduce procedural complexity in the administration of state and federal wetlands conservation programs; and to make restoration, landowner incentive programs and cooperative planning efforts the primary focus of wetlands conservation. This policy is consistent with the expansion of wetlands proposed in the action alternatives.

12.2.2.15 Suisun Marsh Preservation Act and Suisun Marsh Protection Plan

The Nejedly-Bagley-Z'berg Suisun Marsh Preservation Act of 1974 (SB 1981) was designed to protect Suisun Marsh from residential, commercial, and industrial development. The act directed the San Francisco Bay Conservation and Development Commission (BCDC) and CDFW to prepare a protection plan for Suisun Marsh "to preserve the integrity and assure continued wildlife use" of the marsh. The objectives of the protection plan are to preserve and enhance the quality and diversity of the Suisun Marsh's aquatic and wildlife habitats, and to ensure upland areas adjacent to the marsh remain in uses compatible with marsh protection.

In December 1976, BCDC submitted the Suisun Marsh Protection Plan (Protection Plan) to the governor and the legislature. The Protection Plan identifies a Primary Management Area, which encompasses approximately 89,000 acres of bays, sloughs, tidal marsh, wetlands, and lowland grasslands, and a Secondary Management Area, which encompasses approximately 22,500 acres of significant buffer lands (San Francisco Bay Conservation and Development Commission 2007). The Protection Plan is a more specific application of the policies of the San Francisco Bay Plan (Bay Plan) that addresses the unique characteristics of Suisun Marsh. The policies of both the Bay Plan and the Protection Plan apply in the marsh. In the event of a policy conflict between the Bay Plan and the Protection Plan, the policies of the Protection Plan take precedence. The Suisun Marsh Protection Plan was last amended in November 2007.

The Suisun Marsh Preservation Act of 1977 (AB 1717) was enacted to incorporate the findings and policies contained in the Bay Plan into state law. The act designates the BCDC as the state agency with regulatory jurisdiction over Suisun Marsh and calls for the Suisun Resource Conservation District (SRCD) to have responsibility for water management in the marsh.

12.2.2.16 Suisun Marsh Preservation Agreement

On March 2, 1987, the Suisun Marsh Preservation Agreement (SMPA) was signed by DWR, CDFW, Reclamation, and SRDC. The purpose of the SMPA was to establish mitigation for impacts on salinity from the SWP, CVP, and other upstream diversions. The SMPA contains these objectives.

- Ensure that Reclamation and DWR maintain a water supply of adequate quantity and quality for managed wetlands within Suisun Marsh. This is to mitigate adverse effects on these wetlands from SWP and CVP operations, as well as a portion of the adverse effects of other upstream diversions.
- Improve Suisun Marsh wildlife habitat on these managed wetlands.

- Define the obligations of Reclamation and DWR necessary to ensure the water supply, distribution, management facilities, and actions necessary to accomplish these objectives.
- Recognize that water users in Suisun Marsh (i.e., existing landowners) divert water for wildlife habitat management within Suisun Marsh.

On June 20, 2005, a revised SMPA was signed to make channel water salinity requirements consistent with the State Water Board's Decision 1641, and to replace additional large-scale water management facilities with landowner water and management activities to meet the SMPA objectives in the western portion of Suisun Marsh. The agencies that are party to this agreement are also participating in development of the BDCP and must ensure that the BDCP is consistent with the intent to protect wetlands and wildlife in the Suisun Marsh. No restoration is planned in Suisun Marsh under California WaterFix.

12.2.2.17 Central Valley Flood Protection Plan

The Central Valley Flood Protection Plan (CVFPP) was approved by the California Flood Protection Board in June of 2012. The CVFPP provides for a new framework of flood management and flood risk reduction in both the Sacramento and San Joaquin River Basins. It was developed to comply with the Central Valley Flood Protection Act of 2008.

This new plan is focused on providing 200-year flood protection to urban areas in the two river basins, reducing flood risks to small communities and protecting agricultural lands from damage due to flooding. It also has goals, however, that mirror the goals of the action alternatives, including:

- Promote natural dynamic hydrologic and geomorphic processes.
- Increase and improve the quantity, diversity, and connectivity of riparian, wetland, flood plain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.
- Promote the recovery and stability of native species populations and overall biotic community diversity.

The CVFPP includes provisions to include elements of the action alternatives into the overall flood protection actions, once the proposed project is approved. This would include actions to modify the Yolo Bypass and Fremont and Sacramento Weirs.

12.2.2.18 Yolo Bypass Wildlife Area Land Management Plan

The Yolo Bypass Wildlife Area Land Management Plan (LMP) was finalized in June 2008 (California Department of Fish and Game 2008b). The LMP is a general policy guide to CDFW management of the wildlife area and is intended to contribute to habitat management that uses natural processes to create a sustainable system over the long term. The policies are based on an ecosystem approach to habitat management consistent with the principles of the Ecosystem Restoration Program included in the CALFED Bay-Delta Program as implemented by the California Bay-Delta Authority and CDFW. The terrestrial biological resources of the Yolo Bypass that are supported by the LMP have the potential to be affected by implementing CM2 in the BDCP. CM2 is not included as part of California WaterFix.

12.2.3 Regional and Local Plans, Policies, and Regulations

12.2.3.1 City and County General Plans

This section provides a general discussion of goals, objectives, and policies related to terrestrial biological resources in the adopted general plans for each county or incorporated city in the Delta. As discussed in Chapter 13, *Land Use*, state and federal agencies and some local or regional agencies involved with the location or construction of facilities for the production, generation, storage, treatment, or transmission of water, generally are not subject to local land use regulations.

Alameda County

East County Area Plan

Land use planning in the eastern portion of Alameda County is governed by the East County Area Plan (ECAP), which was adopted by the county in May 1994. In November 2000, the Alameda County electorate approved Measure D, the Save Agriculture and Open Space Lands Initiative, which amended portions of the county's general plan, including the ECAP (Alameda County 2000).

The Open Space Element of the ECAP addresses sensitive lands and regionally significant open space, including biological resources. In addition, the East Alameda County Conservation Strategy (EACCS) was developed in 2010 as a planning document that identifies regionally-coordinated mitigation strategies aimed at conserving endangered or threatened species, under the ESA, certain nonlisted species, and habitat in order to offset specific anticipated development, transportation, and infrastructure projects (East Alameda County Conservation Strategy Steering Committee 2010). The EACCS does not allow local agencies to approve permits for projects that could adversely impact threatened and endangered species. Instead, it provides guidance during the project planning and permitting process to ensure that impacts are offset in a biologically effective manner.

Contra Costa County

Contra Costa County General Plan

The Contra Costa County General Plan was adopted in January 1991 and was amended in 1996 and 2005 to reflect changes to the Land Use Map and the incorporation of the City of Oakley (Roche pers. comm. 2009). Three goals in the general plan's Conservation Element provide broad guidance for preservation of plant and animal habitat in the county. The element includes policies that are intended to protect natural habitat, ecological resources, and riparian zones in the county (Contra Costa County 2005).

City of Oakley General Plan

The City of Oakley General Plan was adopted in December 2002. The plan's Open Space and Conservation Element addresses protection and enhancement of environmental resources, including biological resources in the Delta. The Open Space and Conservation Element includes one goal and two policies relevant to the preservation and enhancement of terrestrial biological resources (City of Oakley 2002).

Sacramento County

Sacramento County General Plan

The Sacramento County General Plan was adopted on November 9, 2011. The general plan Open Space Element addresses preservation of natural resources over an extensive area that includes terrestrial and aquatic habitats and agricultural areas. The Open Space Element contains policies regarding protection of wetlands preserves, riparian corridors, woodlands, and floodplains. The element also calls for preparation of a comprehensive open space preservation strategy. The Conservation Element contains policies relating to habitat protection, management and restoration, vernal pools and other wetlands, channel modifications, maintenance of river and stream functions, native and landmark tree protections, and special-status species (Sacramento County 2011).

City of Sacramento General Plan

The City of Sacramento 2030 General Plan was adopted on March 3, 2009. The Environmental Resources Element of the General Plan addresses protection of biological resources, including wildlife habitat, open space corridors, and ecosystems. Eight policies from the Environmental Resources Element are applicable to the action alternatives (City of Sacramento 2009).

San Joaquin County

San Joaquin County General Plan

San Joaquin County General Plan 2010 was adopted in 1992. The plan's Resources Element addresses protection of biological resources, including wetlands; riparian areas; rare, threatened, and endangered species and their habitats; potentially rare or commercially important species; vernal pools; significant oak groves; and heritage trees. Five policies from the Resources Element are considered applicable to the action alternatives (San Joaquin County 1992). The general plan is currently undergoing revision.

Solano County

Solano County General Plan

The Solano County General Plan was adopted in August 2008 and approved by the voters in November 2008. The plan's Resources Element addresses conservation of biological resources throughout the county and specifically within the Delta. Six Resource Element policies concerning natural habitats and biological resources, and, more specifically, concerning the presence of special-status species, wetlands, special-status natural communities, and habitat connections, are considered applicable to the action alternatives (Solano County 2008a).

General plan policies and other polices, programs, and regulations to preserve and enhance the wildlife habitat of Suisun Marsh and to ensure retention of upland areas adjacent to the marsh in uses compatible with its protection have been developed as part of Solano County's component of the Suisun Marsh Local Protection Program. These policies are included as Appendix C of the Solano County General Plan and were certified by BCDC on November 3, 1982, and amended on February 2, 1999 (Solano County 2008b).

City of Rio Vista General Plan

The City of Rio Vista General Plan was adopted in July 2002. The plan's Resource Conservation and Management Element addresses conservation of resources, including biological resources. Two policies from this element concerning wetlands and native riparian habitat protection are considered applicable to the action alternatives (City of Rio Vista 2002).

Yolo County

Yolo County General Plan

The Yolo County General Plan was adopted on November 10, 2009. The plan integrates, by reference, locally effective parts of the DSC's Land Use and Resource Management Plan for the Primary Zone of the Delta. Numerous goals, policies and actions related to the Delta are spread throughout General Plan elements. Conservation and Open Space Element policies concerning special-status communities, heritage valley oak trees, roadside tree rows, special-status species, riparian corridors, native habitat restoration and conservation, and floodplain management are considered applicable to the BDCP (Yolo County 2009). In addition, a policy in the Conservation and Open Space Element calls for ensuring that changes to operation of the Yolo Bypass and Fremont Weir do not damage Yolo County agricultural, development and infrastructure interests. Another Conservation and Open Space Element policy addresses compatibility of the BDCP with the Clarksburg Agricultural District (Yolo County 2009). Many of these goals and policies would also be considered applicable to the California WaterFix.

12.2.3.2 Habitat Conservation Plans

The relationship between the BDCP and other conservation plans that include portions of the study area is discussed in detail in Section 12.3.6, *Effects on Other Conservation Plans*, at the end of this chapter. The plans that are discussed include the East Alameda Conservation Strategy, the East Contra Costa County HCP/NCCP, the San Joaquin County Multi-species Habitat Conservation and Open Space Plan, the South Sacramento HCP, the Solano County Multi-species Habitat Conservation Plan and the Yolo HCP/NCCP.

12.3 Environmental Consequences

This section describes potential direct (temporary, periodic and permanent), indirect, and cumulative effects on terrestrial biological resources that would result with implementation of each alternative. The impact analysis considers each of the alternatives' proposed features in four principal areas: construction of the water conveyance facilities' structural components, which are project-level features; operations and maintenance of these components, which are project-level components; implementation of water management operational scenarios and other covered activities described in Chapter 3, *Description of Alternatives*, which are project-level features; and other conservation components, which are programmatic features. The organization of this section provides for a separate analysis of each of the 19 alternatives being considered, including the No Action Alternative. Six of the project alternatives (1A, 1B, 1C, 4, 4A, and 9) represent the major water conveyance facility options analyzed in this chapter. From a terrestrial biological resources perspective, the differences in effect between these alternatives are related to the construction of the water conveyance facilities (CM1). All other conservation actions (CM2–CM21) are the same, except under Alternatives 5 and 7. The impacts of Alternatives 1A, 1B, 1C, 4, 4A, and 9 are discussed in detail in this chapter. The other action alternatives (2A, 2B, 2C, 2D, 3, 5, 5A, 6A, 6B, 6C, 7, and 8) have very similar or identical project features and impacts on terrestrial biological resources as the major conveyance facility alternatives listed above. All of the alternatives are compared with Existing Conditions and No Action Alternative baselines. To avoid repeating identical analyses for these alternatives (2A, 2B, 2C, 2D, 3, 5, 5A, 6A, 6B, 6C, 7, and 8), their effects are compared, as appropriate, with Alternatives 1A–1C and 4A (for 2D and 5A) to highlight differences among the alternatives. Differences are presented in summary tables and text format and the reader is referred to the similar major conveyance facility alternative for the comparable detailed analysis.

Within each alternative, the analysis focuses on the resources of concern: natural communities, covered animal and plant species, and noncovered animal and plant species. Because this document is designed to satisfy both NEPA and CEQA requirements, each impact analysis presents a NEPA and a CEQA conclusion. The NEPA conclusion has been reached by comparing the effect of the proposed alternative with the effects of the No Action Alternative (the NEPA point of comparison). The CEQA conclusion has been reached by comparing the effect of the proposed alternative to Existing Conditions (the CEQA baseline). The cumulative analysis for all resources and all alternatives and the potential for conflicts with other HCPs are included in separate sections at the end of the chapter.

Terrestrial biological resources associated with the streams and reservoirs upstream of the study area and within the SWP/CVP Export Service Areas are not discussed in detail in this section. The potential for growth-related effects on terrestrial biological resources in the SWP/CVP Export Service Areas is discussed in Chapter 30, *Growth Inducement and Other Indirect Effects*. The potential for project-related changes in average reservoir and river stages upstream of the Delta to affect wetland and riparian habitats in reservoir inundation zones and along streambanks was considered and is discussed in brief for potentially affected natural communities in the study area. CALSIM II model predictions for reservoir volume and discharges for different water-year types and appropriate rating curves (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) were used to predict average water surface elevations (stage) by water-year types. Based on a review of these predictions, it was determined that the changes that could occur upstream of the study area would be within the range of variation in water levels and flows that historically occur in these water bodies. The terrestrial wildlife and vegetation that is supported by these water bodies exist within this variation; changes in the pattern of high and low water levels in certain water-year types and certain months would be expected as a result of implementing the BDCP. Where these operational changes might affect the distribution of natural communities, these changes are discussed in the operation and maintenance impact analyses. Where natural community changes might affect special-status species, these effects are described in the operations and maintenance analyses for those species.

12.3.1 Determination of Effects

The impacts of the action alternatives on terrestrial biological resources may result from construction, operation and maintenance of water conveyance facilities, and from construction and implementation of other conservation measures (Environmental Commitments under Alternatives 4A, 2D, and 5A). This impact analysis assumes that an action alternative would have an effect on terrestrial biological resources if it would directly or indirectly harm or harass individuals or populations of the species considered in this chapter, remove or damage the habitat of these species, or create barriers to the movement of these species.

12.3.1.1 Development of Significance Criteria

The CEQA Guidelines (Title 14, Division 6, Chapter 3 of the CCR), at Section 15064.7, encourage public agencies to develop thresholds of significance to use in determining the significance of environmental effects when complying with CEQA. In this same section, the CEQA Guidelines define a threshold of significance as "an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant." Although Section 15064.7 authorizes a public agency subject to CEQA to conduct a formal public process for formulating significance thresholds that would apply to all of the agency's projects, the courts have recognized that, in preparing an individual CEQA document, a lead agency may informally develop significance criteria applicable to particular projects, provided that such criteria are supported by substantial evidence. (See, e.g., *Oakland Heritage Alliance v. City of Oakland* (2011) 195 Cal.App.4th 884, 896–897; *Citizens for Responsible Equitable Environmental Development v. City of Chula Vista* (2011) 197 Cal.App.4th 327, 336.)

Here the significance criteria used to evaluate impacts on biological resources are based on and incorporate guidance contained in Section 1508.27 of the Council on Environmental Quality (CEQ) NEPA regulations regarding significance determinations; the mandatory findings of significance, as listed in Section 15065 of the State CEQA Guidelines (Title 14, Chapter 3 of the CCR); and criteria contained in Appendix G, "Environmental Checklist Form," of the CEQA Guidelines.

The CEQ NEPA regulations found in Title 40, CFR focus federal agencies' attention on impacts on endangered and threatened species. Section 1508.27 of those regulations defines the word *significantly*, which comes into play in the statutory mandate under NEPA for federal agencies to prepare Environmental Impact Statements for major federal actions *significantly* affecting the human environment (42 USC Section 4321). Under Section 1508.27, federal agencies, in determining whether a major federal action significantly affects the human environment, should consider both the *context* and the *intensity* of the effects at issue. Context relates to the setting for the proposed action (i.e., whether it is regional or local in scale). Intensity "refers to the severity of impact." Among the factors to be considered in assessing intensity are "[t]he degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973."

In enacting CEQA, the legislature found and declared that it was the policy of the state, among other things, to "[p]revent the elimination of fish or wildlife species due to man's activities" and "insure that fish and wildlife populations do not drop below self-perpetuating levels" (Public Resources Code Section 21001[c]). Under CEQA Guidelines Section 15065, which echoes this policy statement, impacts are significant under CEQA if a proposed project would result in any of the conditions listed below.

- Substantially reduce the habitat of a fish or wildlife species.
- Cause a fish or wildlife population to drop below self-sustaining levels.
- Threaten to eliminate a plant or animal community.

- Substantially reduce the number or restrict the range of an endangered, rare or threatened species.

These impact categories, originally formulated in the 1970s, are broadly framed and leave room for expert judgment and application. The sample Initial Study Checklist found in Appendix G to the CEQA Guidelines identifies questions lead agencies should generally ask with respect to a proposed project's potential impacts on biological resources. These questions are often used to give rise to significance thresholds where a proposed project would do any of the following.

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by USFWS or CDFW.
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by USFWS or CDFW.
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including marsh, vernal pool, coastal) through direct removal, filling, hydrological interruption, or other means.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

12.3.1.2 Significance Criteria for Terrestrial Biological Resources

For this analysis, all of the general criteria described above have been tailored to deal with terrestrial species and applied to all determinations of effect for each impact mechanism discussed in the following pages. All aspects of the action alternatives are subject to these criteria, including the construction, operation and maintenance of water conveyance facilities, and the implementation of other conservation measures (Environmental Commitments under Alternatives 4A, 2D, and 5A). Based on the foregoing general criteria, an alternative would have an adverse effect under NEPA and a significant adverse impact under CEQA on terrestrial biological resources if it meets any of the criteria listed below.

- Have a substantial adverse effect, either through direct mortality or through habitat modifications, including designated critical habitat, on any terrestrial plant or wildlife species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW or USFWS, including substantially reducing the number or restricting the range of an endangered, rare, or threatened species. For purposes of this analysis, an effect would be substantial if it would result in:
    - The adverse modification of critical habitat designated by the USFWS;
    - A permanent reduction in the acreage and value of modeled habitats for special-status species (as defined in the BDCP);

    - A permanent reduction in the acreage and value of habitat for noncovered wildlife species within the study area;
    - A permanent reduction in the acreage and value of known occupied habitat for noncovered plant species (based on specific occurrence records) within the study area;
    - A reduction in the availability of mature trees that provide suitable nesting or roosting habitat for special-status birds;
- Have a substantial adverse effect on any sensitive natural community identified in local, state, or federal regional plans, policies, or regulations, including long-term degradation of a sensitive plant community because of substantial alteration of a landform or site conditions. For purposes of this analysis, an effect would be substantial if it would result in a permanent reduction in the acreage and value of the sensitive natural community within the study area.
- Have a substantial adverse effect on federally or state protected wetlands, including marsh, vernal pool, and coastal wetlands, through direct removal. For purposes of this analysis, an effect would be substantial if it would result in a permanent reduction in the acreage of a wetland regulated under Section 404 of the Clean Water Act or the Porter-Cologne Water Quality Control Act.
- Substantially reduce the habitat of a common terrestrial plant or wildlife species. For purposes of this analysis, an effect would be considered substantial if it would cause a common terrestrial plant or wildlife population to drop below self-sustaining levels, or threaten to eliminate a common terrestrial plant or animal community within the study area.
- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict substantially with goals set forth in an approved recovery plan for a federally listed terrestrial plant or wildlife species, or with goals set forth in an approved State Recovery Strategy (Fish and Game Code Section 2112) for a state-listed terrestrial plant or wildlife species. For purposes of this analysis, a conflict would be considered substantial if it would eliminate the possibility of achieving any goal included in a recovery plan.
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. For purposes of this analysis, a conflict would exist if an action alternative:
    - Eliminated existing or planned conservation sites identified in an HCP/NCCP.
    - Required protection, conversion or restoration of cropland or natural communities to the extent that an existing HCP/NCCP could not achieve its conservation goals.
    - Required protection, conversion or restoration of cropland or natural communities to the extent that the Central Valley Joint Venture 2006 Implementation Plan could not achieve its conservation goals.
- Result in effects on terrestrial biological resources that are individually limited but cumulatively considerable.

In the impact discussions that start in Section 12.3.3, the NEPA significance determination follows the main body of the impact analysis. The CEQA significance determination is included in an independent concluding section.

12.3.2 Methods for Analysis

This section describes the methods used to assess the effects of implementing the project alternatives on terrestrial biological resources.

For preparation of the EIR/EIS, the information used to conduct the environmental consequences analysis came primarily from the sources listed below.

- BDCP GIS natural community database.
- BDCP and Appendices.
- Field surveys conducted during 2009 to 2011 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).
- Natural community and wildlife habitat mapping for areas outside of the Plan Area (see Section 12.1.2.1).
- Results of hydrodynamic and salinity modeling (See Chapter 4, *Approach to Environmental Analysis*; Chapter 6, *Surface Water*; Chapter 7, *Groundwater*; and Chapter 8, *Water Quality*, for more information on the methodology for these assessments).
- Results of hydraulic modeling conducted by ESA PWA to determine the extent of tidal marsh expansion in marsh restoration areas (BDCP Appendix 5E, *Habitat Restoration*[8]).
- *BDCP Waterfowl Effects Analysis* (Ducks Unlimited 2013)
- Draft *Bay Delta Conservation Plan Supplemental Shorebird Effects Analysis* (ICF International 2013).
- GIS data layers of water conveyance facilities developed by DWR and other conservation measure footprints developed by BDCP staff.
- DWR mapping of jurisdictional wetlands and waters of the United States within the water conveyance facilities corridors (California Department of Water Resources 2013a, 2013b).

12.3.2.1 Analysis Approach

The methods used to address permanent, temporary, periodic, and indirect effects in this chapter are similar to those used in the BDCP effects analysis (BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*) that were developed for natural communities and BDCP-covered species (Table 12-2 lists covered species). Effects on special-status species that are not covered in the BDCP (referred to as noncovered species; listed in Table 12-3) were evaluated using generally the same methods and assumptions outlined in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, and assessed based on the species habitats (as they are defined in Sections 12.1.3.2 and 12.1.3.3) and occurrences. In addition, other biological resources issues were considered, including effects on state and federally protected wetlands and waters, common plant and wildlife species, wildlife movement corridors, waterfowl and shorebirds, potential for introducing or spreading invasive plants and consistency with other plans and policies.

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[8] As described in Chapter 1, *Introduction*, Section 1.1, Final EIR/EIS should be understood to include not only the EIR/EIS itself and its appendices, but also the proposed BDCP documentation, including all appendices, and the Biological Assessment.

Development of the BDCP effects analysis involved literature review, development of species-specific habitat models for covered species, review of known occurrences of special-status species based on CNDDB and CNPS Inventory records, review of information obtained from species experts, limited field surveys by DWR, and GIS analyses. The BDCP includes an extensive, detailed methodology documenting the specifics of the approach and assumptions for assessing the effects of implementing the BDCP (BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*). Most of these methods were also used for the EIR/EIS analysis of the environmental consequences for terrestrial biological resources. The EIR/EIS team evaluated the affected acreages for covered species and natural communities and confirmed that the determination of effects appropriately considered the specific species assumptions included in the species accounts and defined methods of the BDCP. However, it should be recognized that the BDCP analysis addresses the effects of implementing the BDCP on the covered species list (focusing on requirements of ESA, CESA, and NCCPA). The EIR/EIS assesses a broader range of environmental consequences associated with ESA, CESA, and NCCPA, as well as CEQA, NEPA, CWA, MBTA, and other applicable regulations addressing biological resources. The EIR/EIS does not use the *net effects* assessment method included in the BDCP to identify the benefits to species of implementing the Plan. The determination of benefits to species and the need for mitigation in the EIR/EIS is outlined below in Section 12.3.2.5, *Methods Used to Consider Mitigation*. The determination of benefits for the BDCP alteranatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) relies on the acreage commitments defined in the BDCP and for the non-HCP alernatives (4A, 2D, and 5A) relies on the acreages presented in Chapter 3, *Description of Alternatives*, Section 3.5.

The acreages for the Environmental Commitments under Alternatives 4A (Table 3-9 in Chapter 3), 2D (Table 3-10), and 5A (Table 3-11) were developed by taking into consideration the analysis conducted in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, for the BDCP alternatives, which used typical mitigation ratios to determine the sufficiency of the BDCP conservation strategy as CEQA and NEPA mitigation (i.e., whether the BDCP conservation strategy includes sufficient land acquisition and restoration to adequately mitigate the impacts of CM1 for purposes of CEQA and NEPA).

The first step involved estimating the acreages of natural communities and modeled habitat that could be affected by the construction of Alternative 4A and other non-HCP Alternatives. To approximate the estimated effects from Alternative 4A and the other non-HCP alternatives, the same natural community mapping and species models used for the BDCP alternatives were utilized. The resulting estimates are relatively conservative when considering the resolution of this data (i.e., the natural community and modeled habitat data tend to overestimate the extent of these features across the Plan Area), as well as because access to specific areas along the potential construction footprints were limited (see also the discussion of the environmental setting/affected environment within this chapter).

The next step involved applying typical mitigation ratios to the water conveyance facility impacts on natural communities to obtain the restoration and protection acreages necessary to mitigate these impacts. Once these initial natural community restoration and protection acreages were identified, they were then compared with the mitigation requirements for species addressed in the EIR/EIS that use these natural communities as habitat. Several of the species analyzed in the EIR/EIS utilize the same general natural communities but may only use specific subsets of these natural communities or are geographically restricted to certain portions of the study area where these natural communities occur. Therefore, the total acreages of proposed natural community restoration and protection were increased to account for species needs. For example, if species A needed 5 acres of riparian scrub protected and species B needed 5 acres of mature riparian protected, then up to 10 acres of valley/foothill riparian would be protected in total and where the habitat needs for both species are the same, the mitigation acreage would be the same.

The next step was then to estimate the impacts the proposed restoration would have on natural communities and species habitats within the study area. Assumptions on where restoration would likely occur (e.g., which CZs and ROAs) and how it would be implemented were taken from the relevant BDCP Conservation Measures to determine which natural communities would likely be affected by these activities. Where restoration efforts were anticipated to result in additional impacts on natural communities and species habitats, the restoration and protection acreages where increased accordingly. Through this iterative process, project biologists were able to determine the maximum acreages for natural community protection and restoration that would be sufficient to offset the loss or conversion of natural communities and species habitats from water conveyance construction and proposed restoration activities.

Direct and Indirect Effects

This impact analysis contains an assessment of both the direct and reasonably foreseeable indirect effects of the action alternatives. This analysis establishes the maximum potential for impacts and may not reflect the final impact as some restoration and protection actions have been analyzed programmatically. Direct effects of constructing water conveyance facilities for individual alternatives as well as implementing conservation measures/Environmental Commitments consist of habitat removal and construction or inundation-related disturbances, mortality of wildlife or plants, immediate displacement of wildlife, immediate degradation of habitats, and direct removal of natural communities.

Indirect effects consist of project-related effects that would occur later in time or farther removed in distance than the direct effects. These potential effects consist of alterations to species habitats that are adjacent to directly affected areas (e.g., changes in hydrology in adjacent areas), disturbances to nearby wildlife during construction (e.g., disruption of breeding and foraging behaviors from noise, light and glare), and other effects occurring later in time (e.g., collisions of birds with transmission lines built to meet BDCP requirements and fragmentation of habitat). Indirect effects can result both from construction and from operations and maintenance (e.g., ground disturbance could result in the spread and establishment of invasive plants).

Indirect effects for both covered and noncovered species were assessed qualitatively, except for effects on vernal pool crustaceans and greater sandhill crane, which were assessed quantitatively. Indirect effects for vernal pool crustaceans were estimated by buffering water conveyance and hypothetical restoration footprints by 250 feet. Other sources that supported analysis of indirect effects included the greater sandhill crane noise analysis (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*), EIR/EIS Chapter 23, *Noise*, and Table 5.J-4 and 5.J-5 in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*.

The direct effects of constructing the water conveyance facilities would be the result of, but would not be limited to, the types of actions listed below.

- Clearing and grubbing for physical water conveyance components (e.g., intake facilities and infrastructure, levees), staging areas, storage/stockpile areas, construction crew parking, and construction access roads.
- Excavating and drilling for physical water conveyance components (e.g., geotechnical exploration, borrow pits, pipelines, forebays, sedimentation basins, canals, tunnel access shafts).
- Dredging waterways.
- Importing, distributing, storing, or disposing of fill, borrow, spoil, or dredge material.
- On-road and off-road traffic from construction vehicles (e.g., water and cement trucks), personal vehicles of construction staff, and transport of construction equipment within the study area and to/from the study area.

As discussed in Chapter 3, Section 3.6.1.10 *Geotechnical Exploration*, DWR has developed a Draft Geotechnical Exploration Plan for the Alternative 4 conveyance alignment (also applicable to Alternative 4A). This would include 1,500 to 1,550 locations for drilling boreholes (each approximately 8 inches in diameter, which will be grouted) and cone penetration testing, which consists of pushing a cone connected to a series of rods into the ground at a constant rate, allowing continuous measurements of resistance to penetration both at the cone tip and the sleeve behind the cone tip. Also, 60 shallow test pit excavations will be dug (typically 4 feet wide, 12 feet long, and 12 feet deep). All of these activities will take place in area where surface and subsurface features for the water conveyance facilities are planned. The various on-land exploration methods may last from a few hours to several days. The exact locations of these activities are not yet known.

Preliminary estimates of temporary impacts from geotechnical exploration for Alternatives 4 and 4A were made based on DWR's experience with these type of activities and some preliminary field estimates. A geographic footprint represented in GIS data layers was used to conservatively estimate the area potentially disturbed by geotechnical exploration activities. This footprint consisted of a series of points along the conveyance alignment that were selected based on an assessment of the needs for more detailed geotechnical information. It is expected that the geotechnical exploration sites will result in approximately 0.84 acre of disturbance per site, which includes a 0.23-acre (10,000 square feet) area of temporary disturbance for drilling and staging plus an additional 0.61 acres of temporary disturbance associated with accessing the sites, which would consist of overland travel in agricultural areas and grasslands and which could result in temporary disturbance to vegetation. For the analysis, the geotechnical exploration sites, which are represented by points in GIS, were overlain on the conveyance footprint and intersected with the surface footprints and subsurface footprints to establish geotechnical exploration zones. Not all surface features were included as part of the surface geotechnical exploration zones because features had not been identified as potential geotechnical exploration sites (i.e., these areas did not have geotechnical exploration site GIS point data within in them). The area of the geotechnical exploration zones was then combined with the number of geotechnical exploration sites to estimate the total temporary impact. Estimates of impacts on natural communities and modeled habitat for species were generated by applying the proportion of the estimated impact acreages within the geotechnical exploration zones to the known acreage of natural communities and modeled habitat within each zone.

The direct and indirect effects of operating and maintaining the water conveyance facilities would result from a wide range of activities over the life of the action alternatives. The proposed intake facilities (including intake pumping plants, sedimentation basins and solids lagoons) would require scheduled routine or periodic adjustment and tuning to remain consistent with design intentions. Emergency maintenance is also anticipated. Routine facility maintenance would consist of activities such as painting, cleaning, repairs, and other tasks to operate facilities in accordance with design standards after construction and commissioning. Maintenance activities associated with river intakes could include removal of sediments, debris, and biofouling materials. These maintenance actions could require suction dredging or mechanical excavation around intake structures; dewatering; or use of underwater diving crews, boom trucks or rubber wheel cranes, and raft- or barge-mounted equipment. Sediment in solids lagoons and channels would also be removed periodically.

Maintenance requirements for the canal segments of alternatives would include erosion control, control of vegetation and rodents, embankment repairs in the event of flooding and wind wave action, and monitoring of seepage flows. The sediment traps constructed in channels and canals would be periodically dredged to remove the trapped sediment.

Direct and indirect effects from implementation of habitat restoration and enhancement conservation measures would be anticipated to result from the types of actions listed below.

- Grading, excavation, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.
- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Construction of new infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Removal of existing vegetation and planting/seeding of vegetation.
- Controlling the establishment of nonnative vegetation to encourage the establishment of target native plant species.
- Control of nonnative predator and competitor species (e.g., feral cats, rats, nonnative foxes).

Habitat management actions include all activities undertaken to maintain the intended functions of protected, restored, and enhanced habitats over the term of the action alternatives. Habitat management actions that could create direct and indirect effects on terrestrial biological resources are anticipated to include the activities listed below.

- Minor grading, excavation, and filling to maintain infrastructure and habitat functions (e.g., levee maintenance; grading or placement of fill to eliminate fish stranding locations).
- Maintenance of infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure, fences).
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Ongoing control of terrestrial and aquatic nonnative plant and wildlife species.

Effects Duration

Some effects described in this chapter have been categorized based on their duration. Proposed project effects on terrestrial biological resources could be permanent, temporary, or periodic, as defined below.

Effects have been categorized as *permanent* where a biological resource would be removed or lost and would not be replaced at its original site. Permanent effects would occur primarily at construction sites. Construction of aboveground water conveyance structures and ancillary facilities, and similar structures or facilities associated with other conservation measures would permanently remove or alter habitats and could result in the loss of individual special-status plants or animals. Development and use of reusable tunnel material (RTM) storage sites have been characterized as permanent losses of biological resources because of the uncertainty of replacing the resource and the length of time between the loss of the resource and the first opportunity to restore or replace the resource after dewatering and chemical characterization of the RTM (as much as 5 to 10 years). Activities associated with tunneling and RTM placement are likely to occur across multiple years at RTM storage areas.

Even though RTM-related resource damage is being considered permanent for purposes of the impact analysis, there is an environmental commitment to reuse the material or dispose of it at appropriate facilities, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. It is anticipated that much of the material would be removed from storage areas and applied, as appropriate, as bulking material for levee maintenance or as fill material for habitat restoration projects, or would be put to other beneficial reuses. Following removal of material, stockpiled topsoil at RTM storage areas would be reapplied, and disturbed areas would be returned as near as feasible to preconstruction conditions.

Effects have been categorized as *temporary* where construction-related habitat losses would be restored to the affected area's predisturbance condition within one year of completing construction. The types of areas that would be expected to be restored include borrow and spoil disposal sites, barge facility work areas, bridge/control work areas, bridge work areas, canal work areas, intake work areas, pumping plant work areas, channel enlargement work areas, control structure work areas, dredging work areas, operable barrier work areas, pipeline work areas, railroad work areas, temporary access road work areas, safe haven work areas, and siphon work areas. Because water conveyance construction would take place over a 9 to 14-year period with varying periods of activity at individual construction sites, there is uncertainty as to the length of time these temporarily affected areas would be disturbed prior to restoration. Therefore, temporary effects on some terrestrial plants and wildlife are treated as a permanent loss of habitat for the purposes of determining the amount of conservation action necessary to offset these effects.

Effects have been categorized as *periodic* where they would result from cyclical or irregular activities associated with operation of the water conveyance facilities or other conservation measures associated with the action alternatives. Periodic inundation effects on the biological resources of the Yolo Bypass would result from modifications to the Fremont Weir and controlled flooding of the bypass, which would cause inundation at a frequency, duration, and magnitude that exceeds the current inundation regime (a result of implementing CM2 under the BDCP alternatives). Periodic dredging of Middle River and Victoria Canal under Alternative 9 (Through Delta/Separate Corridors) would cause sedimentation and turbidity in adjacent wetlands and riparian habitat. Periodic inundation resulting from seasonal floodplain restoration (CM5 under the BDCP alternatives) would affect natural communities and special-status species occupying the newly created floodplains.

Effects Time Periods

Effects of the BDCP were also evaluated for two timeframes for all natural communities and special-status species: the near-term, which extends from years 1–10 of BDCP implementation; and the late long-term, which covers the entire 50-year term of the BDCP, after which the ESA and NCCPA permits expire (years 1–50). Most of the water conveyance facilities would be constructed during the near-term, along with initial implementation of habitat restoration, enhancement, and protection, and other conservation components. The habitat restoration, enhancement, and protection, and the activities associated with the other conservation components would be initiated at the outset of Plan implementation and would continue to be implemented throughout the lifetime of the permits. Table 3-4 in Chapter 3, *Description of Alternatives,* provides a summary of the BDCP's restoration and protection commitments for each time period.

The estimate for constructing the water conveyance facilities has changed from 10 years (near-term) under the Draft EIR/EIS to 9 to 14 years for the Final EIR/EIS. The analysis for the BDCP alternatives still refers to the near-term time period and considers all water conveyance impacts over this time period. The proposed restoration and protection considered for the near-term analysis still refers to the acreages put forth in Table 3-4 in Chapter 3, *Description of Alternatives*, (Table 6-2 in BDCP Chapter 6, *Plan Implementation*) for years 1–10 because these acreages were developed to be in rough proportion to the impacts for water conveyance construction; furthermore, the BDCP commits to pace the implementation of the conservation measures such that they may not fall behind the pace of covered activity impacts by more than 10%, which complies with the NCCPA requirement for rough proportionality.

Alternatives 4A, 2D, and 5A were evaluated over the early long-term in order to cover the entire water conveyance construction period.

12.3.2.2 Methods Used to Assess Natural Community Effects

The natural community effects analysis includes a discussion of individual conservation measures (Environmental Commitments under Alternatives 4A, 2D, and 5A) and the combined effects of implementing all of the BDCP conservation measures (Enviornmental Commitments): habitat restoration actions, other conservation measures, and construction and operation of the water conveyance facilities. The direct and indirect effects of these actions and operation and maintenance of all facilities have been included. In addition, effects on habitat value have been considered and addressed where relevant, including effects of habitat fragmentation, connectivity, patch size and degradation of habitat functions. These effects have been assessed qualitatively based on changes in the distribution and extent of each natural community removed or gained relative to existing distributions. For the BDCP alternatives, this assessment has been conducted by reviewing water conveyance facilities and hypothetical restoration and enhancement area footprints over aerial imagery to determine whether these activities would fragment existing natural communities or disrupt potentially important wildlife migration corridors. For Alternatives 4A, 2D, and 5A, the same assessment described above was applied to the water conveyance facility footprint, but no hypothetical restoration or enhancement footprints were available. Migration corridor and habitat fragmentation and connectivity as they relate to natural community distribution have also been considered qualitatively by reviewing landscape linkages (within the Plan Area and on a regional scale) identified by CDFW and reported in the BDCP (see BDCP Chapter 3, Table 3.2-3, and Figure 3.2-16), and by considering how physical facilities might impede terrestrial species movement through natural communities and conservation lands. Field survey information reported in

Appendix 12C and information collected in reconnaissance site visits by qualified biologists have also contributed to qualitative assessments of habitat heterogeneity, presence of buffers, and species-specific habitat requirements

The natural community effects assessment includes an assessment of effects on wetlands and other sensitive habitats. Restoration and enhancement measures and construction of water conveyance facilities would have temporary and permanent effects on wetlands. Natural communities that could qualify as wetlands are tidal and nontidal perennial aquatic, tidal freshwater emergent wetland, nontidal freshwater perennial emergent wetland, vernal pool complex, alkali seasonal wetland complex, managed wetland, other natural seasonal wetland, and valley/foothill riparian.

Water Conveyance Facilities

The GIS layers depicting all water conveyance construction activities that could affect the natural communities (e.g., grading, excavation, paving) have been overlain with the natural communities GIS layer. Direct effects of constructing water conveyance facilities have been classified as permanent or temporary based on the duration of the effect as described above under *Effects Duration.* Indirect effects on natural communities from constructing the water conveyance facilities are not discussed in detail in this chapter. The Plan contains a substantial list of avoidance and minimization measures that would be implemented during water conveyance facilities construction to avoid and minimize effects on adjacent wetlands and other vegetation types, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

Restoration, Enhancement, and Protection

Habitat restoration, enhancement and protection actions under the BDCP alternatives are proposed for implementation over the 50-year life of the Plan, or would be implemented concurrent with the construction of the water conveyance facilities under Alternatives 4A, 2D, and 5A. Implementing CM2–CM11 under the BDCP, or Environmental Commitments 3, 4, 6–11 under Alternatives 4A, 2D, and 5A, which are focused on habitat restoration, enhancement, and protection, would result in physical changes to existing terrestrial biological resources. The BDCP conservation measures designed to address “other stressors” on aquatic species (CM12–CM21, or Environmental Commitments 12, 15, and 16 under the non-HCP alternatives) were not considered to have effects on terrestrial biological resources, but are discussed briefly where applicable in Section 12.3, *Environmental Consequences*.

Detailed plans for restoration, enhancement, and preservation actions have not been prepared for multiple reasons: 1) because the habitat restoration and enhancement would be implemented, if feasible, in areas with willing sellers, none of whom has been identified; 2) to maintain flexibility in the BDCP for adaptive management; and 3) because BDCP implementation has a long timeframe. However, although specific locations proposed for habitat restoration and enhancement have not been defined at this time, the EIR/EIS must quantify the environmental effects to the degree of specificity available for the project description. Therefore, the assessment of the effects for the habitat restoration and enhancement was programmatic. The analysis has focused on the geographic areas identified in the BDCP as most likely to support restoration, enhancement and protection. These geographic areas have been characterized as CZs that encompass the entire Plan Area (see Figures 3-1 and 12-1), and, for tidal natural communities restoration, as ROAs that focus on smaller regions of the Plan Area (see Figure 12-1). These geographic divisions are described in Section 12.1 *Environmental Setting/Affected Environment*.

For the programmatic analysis of the BDCP alternatives, natural communities that might be modified for habitat restoration were quantified using a GIS layer that included preliminary footprints for some types of restoration. Preliminary footprints were established *for CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The acreages of natural community types that would be removed by restoration were calculated, as were the acreages of natural community types that would develop after restoration based on site attributes, such as soil types and topography. For riparian, nontidal, and grassland restoration, impacts were estimated using the methods and assumptions that are summarized in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. For Alternatives 4A, 2D, and 5A, no hypothetical footprints for tidal restoration were available; therefore, impacts were estimated. These impacts were estimated by first assuming that tidal restoration under these alternatives would take place in the Cache Slough and West Delta ROAs (areas most likely to have tidal restoration conducted for the benefit of fish), then developing the proportions of natural communities occurring in these two ROAs combined, and then multiplying those proportions by the proposed tidal restoration acreage under Alternatives 4A, 2D, and 5A. Additional methods and assumptions listed in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants,* were also applied to the tidal restoration estimates for Alternatives 4A, 2D, and 5A. Additional NEPA and CEQA considerations may be necessary in the future when actual restoration projects are proposed.

In addition to the direct loss of terrestrial communities associated with the conversion, indirect effects associated with a change in tidal action, and changes in salinity could occur. Potential changes to terrestrial communities associated with changes to tidal actions were evaluated using output from two-dimensional hydrodynamic RMA modeling.

12.3.2.3 Methods Used to Assess Species Effects

The analysis of effects on terrestrial plant and wildlife species in this chapter considers the direct and indirect effects of implementing proposed project conservation actions for restoration, enhancement, and preservation (CM2–CM11 under BDCP alternatives, and Environmental Commitments 3, 4, 6–11 under Alternatives 4A, 2D, and 5A), and water conveyance facilities. The assessment evaluates permanent, temporary, and periodic effects on terrestrial species, including special-status species.

From 2009 through 2011, DHCCP and consulting biologists conducted field surveys for special-status species that have the potential to occur in the Plan Area. These surveys were limited to public lands and to private lands that were accessible for the surveys. The methods and a summary of the results for these surveys are provided in Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*. All observed special-status species occurrences were entered into a GIS database. The survey results were in some cases used to modify the BDCP species-habitat models. The survey results were primarily used to verify species-habitat relationships. These results were used together with occurrence data in the CNDDB to determine whether construction footprints would affect these species occurrences; in some cases, project footprints were modified to avoid sensitive areas. Since the release of the DHCCP report (Appendix 12C), some of the DHCCP occurrence data has been incorporated into the CNDDB. As noted above, the DHCCP surveys did not occur on all lands within the conveyance alignment footprints and the CNDDB data is limited by where previous surveys have occurred; therefore, the actual effects to individuals or populations may be higher than is presented in the species effects discussions for the water conveyance facilities.

Covered Species

For covered species, the BDCP team developed species-habitat models that are presented in BDCP Appendix 2.A, *Covered Species Accounts*. These GIS-based species-habitat models consist of a GIS layer of potentially suitable habitat for the species based on its habitat requirements, which were modeled using several GIS data sources depicting vegetation, soils, topography, land use, and other parameters. The methods used by the BDCP to determine effects on covered species are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The analysis of the effects from conveyance facility construction and restoration actions were analyzed quantitatively where specific (conveyance facilities) or hypothetical (restoration) footprints were available. Effects from other conservation actions, such as enhancement, management, operations, and maintenance were analyzed qualitatively.

The species-habitat models were reviewed by the EIR/EIS lead agencies, USFWS, and CDFW. The models have limitations in their ability to estimate habitat area with precision. In some cases, they may overestimate the extent of habitat because they do not incorporate information such as microhabitat conditions and other site-specific variables (e.g., water depth, habitat structure). Conversely, because of minimum mapping unit limitations, some of the models identify areas as nonhabitat that do support species habitat. For example, habitat areas that are smaller than the minimum mapping unit size (1 acre) may not be identified. This may be important for species that can use small, isolated habitats, such as birds that nest in isolated individual trees or small groups of trees. Where applicable, wildlife species' habitat was also identified according to type (e.g., breeding, foraging, or dispersal habitat).

It is important to note that although the models portray a reasonable distribution of habitat for each covered species, they do not necessarily indicate with certainty that covered species are restricted to those areas. Instead, the models indicate that nonhabitat areas have a much lower probability of species occurrence compared with areas identified as habitat. In some cases the BDCP models were developed using site-specific species occurrence information from the CNDDB and information from extensive field surveys conducted in and around water conveyance facility footprints by DWR (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). BDCP species-habitat models were used to identify suitable habitat as a regionwide evaluation tool in this EIR/EIS.

Effects of constructing water conveyance facilities on covered species have been analyzed using the same species-habitat GIS models as were used for restoration measures. Facility footprints were overlain on species' habitat GIS layers, and the acreages of temporary and permanent effects were calculated. Depending on the species biology, indirect effects were assessed either quantitatively or qualitatively, based on a description of the construction activities (see Chapter 3, *Description of the Alternatives*). To make the water conveyance facilities impact analysis more site-specific, species occurrence data were evaluated as a component of the value assessment for habitat. DHCCP and consulting biologists conducted extensive field surveys recently in and around the conveyance facilities footprint and alternative alignments for this facility. Therefore, occurrence data have been used to assess effects of the conveyance facilities construction (CM1) to a greater extent than they are used to assess effects of other conservation measures.

Effects of construction noise on greater sandhill crane habitat were estimated by calculating the distances from construction sites subject to noise above 60 dBA (A-weighted decibels), and 50 dBA (see Section 11F.5.1 of Appendix 11F, *Substantive BDCP Revisions*; for a discussion of noise levels, see Chapter 23, *Noise*). Construction activities were classified into five construction activity types that each were assumed to have a typical noise level. Categories of noise sources at construction sites (measured at 50 feet distance) are listed below.

- Impact pile driving: 101 dBA.
- Multiple source construction activities: 96 dBA.
- Conveyor belt return/load/booster drive (Alternative 4 only): 85 dBA.
- Conveyor belt mid-segment (Alternative 4 only): 75 dBA.
- Heavy trucks: 85 dBA.

Pile driving was analyzed separately due to the unique characteristics of noise produced from this noise source (intermittent impact noise). Multiple source construction noise was characterized by calculating the noise levels that would be produced when the loudest six pieces of construction equipment were operating simultaneously, and noise from heavy trucks was calculated assuming three heavy trucks operating in the same general area simultaneously.

To assess the potential effect of noise on sandhill cranes the noise level expected was calculated for known roosting habitat (at temporary and permanent roosts), and in modeled foraging habitat. Calculations assumed direct line-of-sight (no intervening barriers) with an atmospheric noise attenuation rate of approximately 6 dBA with each doubling of distance plus an additional attenuation of 1.5 dBA noise absorption due to propagation over soft ground (e.g., agricultural land, open natural habitat). Therefore, total noise attenuation was calculated as 7.5 dBA per doubling of distance from the source. For construction noise, distance to noise level contours were calculated from the edge of each identified construction area, giving a conservative worst-case estimate of noise levels because most of the construction activity would not take place on the perimeter of each site.

Overlay of the noise contours on the modeled foraging and known temporary and permanent roost sites was used to calculate the areas affected by expected worst-case noise levels above 60 dBA and 50 dBA. When the noise levels from different noise categories overlapped, the category with the highest noise level was assumed to be operating. More detail on the methods for determining the construction noise effects on greater sandhill crane habitat can be found in Section 11F.5.1 of Appendix 11F, *Substantive BDCP Revisions*.

Using global position system receivers, the DHCCP surveys also mapped locations of elderberry shrubs (which are used by valley elderberry longhorn beetle to complete its lifecycle) in the DHCCP Conveyance Planning Area, where accessible. The spatial data collected consisted of point and line data and was attributed with size class, habitat found in, an estimate of the number of stems, and in some cases the estimate of the number of shrubs associated with a spatial feature (i.e., some lines represented as many as 160 shrubs). To determine the number of elderberry shrubs potentially impacted by CM1 for each alternative, ICF GIS staff intersected the conveyance alignment alternatives with the elderberry shrub line and point data. Where an individual line represented multiple shrubs along a channel, an estimate of the number of shrubs impacted by a particular conveyance alignment was generated by multiplying the number of shrubs represented by the line by the proportion of the line intersected by the conveyance alignment. For example, if a 1,000-foot-long line representing 100 shrubs had 500 feet of its length intersected by one of the conveyance alignment alternatives, then the 100 shrub total was multiplied by 0.50 (500/1,000) to come up with an estimate of 50 shrubs impacted.

Changes in salinity, selenium and methylmercury and their potential effects on covered species have been assessed qualitatively based on extrapolation of water quality modeling results. These potential effects are based on salinity modeling results that were used to predict the extent of available habitat for species that depend on brackish or freshwater tidal emergent wetland, as well as modeling results for selenium and methylmercury (see Chapter 8, *Water Quality*, and BDCP Appendix 5.D, *Contaminants*).

Noncovered Species

Effects on noncovered species were determined in GIS using the same construction and hypothetical footprints overlain on habitat models developed by ICF staff for these species. As described in Sections 12.1.3.2 and 12.1.3.3, modeled habitat for noncovered species in the study area was defined by one or more of the following characteristics: species range; natural communities in which the species are found; and occurrence records. In cases where covered and noncovered species have the same habitat requirements (e.g., the covered least Bell's vireo and the noncovered yellow warbler), modeled habitat for the covered species was applied to the noncovered species. For a few species that have specific habitat elements that are at a smaller scale than the minimum mapping units used in the BDCP vegetation/land cover dataset (e.g., sand bar habitat for anthicid beetles) the extent of habitat and impacts from conservation measures were qualitatively evaluated.

Plant Species

Detailed habitat models similar to those in the BDCP have not been created for noncovered special-status plant species (Table 12-3). The impact analysis relies largely on species occurrences but also considers impacts on the natural communities in which species occur and considers models for covered species that have the same habitat requirements as noncovered species have. Species occurrence information in the study area was obtained from the CNDDB and surveys conducted for the Delta Habitat Conservation and Conveyance Program (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). GIS data layers have been created for the noncovered special-status plant species, with separate layers based on whether the occurrences are geographically specific or nonspecific. Impacts have been determined by overlaying the footprint of conservation measures on the mapped occurrences. All occurrences partly or completely overlapped by the footprint have been considered to be affected. All impacts resulting from ground disturbance have been assumed to be permanent, even if the disturbed area would be later restored, because there is no basis for assuming that the restored habitat would still be suitable for the affected species. Indirect effects, such as the predicted shifts in salinities or increased erosion in wetlands, have been assessed qualitatively.

Wildlife Species

For noncovered wildlife species, ICF EIR/EIS staff described relationships between natural communities and species habitat that were developed based on literature and review of species databases, including CNDDB and California Wildlife Habitat Relationships (CWHR), and that are discussed in Section 12.1.3.2. ICF GIS staff developed habitat models for noncovered species for use in determining effects following the descriptions provided in Section 12.1.3.2 and in coordination with ICF biologists.

Changes in salinity, selenium and methylmercury and their potential effects on noncovered species have been assessed qualitatively based on extrapolation of water quality modeling results. These potential effects are based on salinity modeling results that were used to predict the extent of available habitat for species that depend on brackish or freshwater tidal emergent wetland, as well as modeling results for selenium and methylmercury (see Chapter 8, *Water Quality*, and BDCP Appendix 5.D, *Contaminants*).

Common Species

Common plant and wildlife species are considered in the context of project effects on natural communities. There is a very wide range in natural communities and associated common species in the study area. To the extent that natural communities are directly or indirectly affected by BDCP actions, the associated common species are also affected. The potential for effects on these common species are offset to varying degrees by the long-term conservation strategies contained in the BDCP and the habitat protection and restoration that is envisioned in those conservation strategies.

Wildlife Corridors

The potential effects of the alternatives on wildlife corridors in the study area were primarily evaluated using GIS data from the California Essential Habitat Connectivity (CEHC) Project and from a landscape linkage analysis conducted for the BDCP (see BDCP Chapter 3, Section 3.2.5, *Landscape Linkages*). This information was used to determine if any of the BDCP actions would result in barriers across known or potential natural lands that serve as wildlife corridors or conflict with BDCP Objective L3.1 and siting and reserve design criteria defined in *CM3 Natural Communities Protection and Restoration*. The alternatives were also evaluated for effects on wildlife corridors by reviewing aerial imagery with the proposed conveyance facilities alternatives, ROAs, the natural community data, CNDDB records, and data from DHCCP surveys. Effects on wildlife corridors for individual species are addressed in more detail in their respective effects discussions.

The CEHC Project was commissioned by the California Department of Transportation and CDFW with the purpose of making transportation and land-use planning more efficient and less costly, while helping reduce dangerous wildlife-vehicle collisions (Spencer et al 2010). The CEHC identified natural blocks of habitat across California and areas that potentially provide linkages between these blocks. The CEHC identifies these areas as Essential Connectivity Areas (ECAs). The ECAs were not developed for the purpose of defining areas subject to specific regulations by the CDFW or other agencies. The ECAs are identified as lands likely to be important to wildlife movement between large, mostly natural areas at the statewide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. The ECAs were not developed for the needs of particular species but were based primarily on the concept of ecological integrity, which considers the degree of land conversion, residential housing impacts, road impacts, and status of forest structure (for forested areas) (Spencer et al 2010). In addition, consideration was given to the degree of conservation protection and areas known to support high biological values, such as mapped critical habitat and hotspots of species endemism (Spencer et al 2010). The ECAs are intended as placeholder polygons that can inform land-planning efforts, but they should eventually be replaced by more detailed linkage designs, developed at finer resolution at the regional and ultimately local scale based on the needs of particular species and ecological processes.

With this in mind, the ECAs were overlain on the study area to identify whether these general areas represent potential habitat linkages for wildlife that occur within or likely disperse through the study area. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The first area is composed of three separate ECAs that converge in the Yolo Bypass: one coming from the north (Yolo Bypass-Sacramento Bypass ECA), one coming from the south (Little Holland Tract/Yolo Bypass-Yolo Bypass ECA), and one from the east from CZ 4, across CZ 3, linking the Yolo Bypass to Stone Lakes (Stone Lake-Yolo Bypass ECA). Another ECA was identified coming into CZ 4 from the east, generally following the Cosumnes Preserve and terminating at I-5 (Bear Slough-Browns Creek ECA). Another was identified in the central Delta generally running north-south from CZ 5 into CZ 6, from Staten Island to Mandeville Island (Mandeville Island-Staten Island ECA). The last area is in CZ 11 and consists of an ECA coming into Suisun Marsh from the northwest (Grizzly Island-Lake Marie ECA).

CDFW staff participating in the development of the BDCP identified potential linkages important for covered species for incorporation into the reserve design process (see BDCP Chapter 3, Section 3.2.5, *Landscape Linkages*). These linkages were inferred from the BDCP land cover data, species occurrence data, and covered species habitat models (see BDCP Figure 3.2-16). These linkages were drawn at a regional level as broad swaths of natural land cover types rather than specific alignments or corridors. Two types of linkages were identified in the BDCP: regional connections, which focus on maintaining linkages with areas outside the Plan Area, and connections within the Plan Area, which focus on linking populations within the Plan Area. These linkages were developed with individual species or a suite of species in mind. The purpose and likely benefit of each linkage shown in BDCP Figure 3.2-16 are presented in BDCP Chapter 3, Table 3.2-3. A summary of the purpose for and a list of the covered species likely to benefit from the 11 linkages is presented below.

Regional Connections

1. *Jepson Prairie* – Provide connectivity within Jepson Prairie and between CZs 1 and 11; benefit vernal pool crustaceans and plants, and California tiger salamander.
2. *West to Contra Costa County* – Provide connectivity between the Plan Area and protected lands in East Contra Costa County; benefit vernal pool crustaceans and plants, alkali seasonal wetland plants, California red-legged frog, California tiger salamander, and San Joaquin kit fox.
3. *Yolo Bypass* – Provide connectivity for adult fish migration through Yolo Bypass; benefit adult salmonids and sturgeon, and juvenile salmonids and Sacramento splittail.
4. *San Joaquin River to the south* – Provide connectivity for natural community and species habitat functions; benefit riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite.

Connections within the Plan Area

5. *San Joaquin River* – Provide aquatic and riparian connectivity along the San Joaquin River; benefit riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite.
6. *Middle River* – Provide riparian connectivity along the Middle River; benefit riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite.
7. *Old River* – Provide riparian connectivity along the Old River from San Joaquin River to Clifton Court Forebay; benefit riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite.

8. *Deep Water Ship Channel* – Provide direct route for fish migration along San Joaquin River to spawning habitat upstream of Stockton; benefit Chinook salmon, steelhead, green sturgeon, and white sturgeon.
9. *Sacramento River* – Provide sufficient flows through Sacramento River downstream of North Delta intakes and limit entrainment to retain movement capacity for covered fish; benefit delta smelt, longfin smelt, Chinook salmon, steelhead, green sturgeon, and white sturgeon.
10. *Cosumnes to Stone Lakes* – Provide at least two greater sandhill crane roosting and foraging sites connecting the population in the vicinity of Cosumnes River Preserve with the population in the vicinity of Stone Lakes NWR.
11. *White Slough to Stone Lakes* – Provide giant garter snake habitat connecting the White Slough population to habitat in the Stone Lakes area

The linkages depicted in BDCP Figure 3.2-2 are included in Figure 12-2 for the purpose of identifying potential conflicts between wildlife corridors to be enhanced and developed under *CM3 Natural Communities Protection and Restoration* and the CM1 alternatives being considered in the EIR/EIS. Where applicable, these potential conflicts are also addressed in the effects discussions for individual terrestrial species.

12.3.2.4 Methods Used to Assess Wetlands and Other Waters of the United States

The term *waters of the United States* is an encompassing term used by USACE for areas that are subject to federal regulation under Section 404 of the CWA. Waters of the United States are categorized as *wetlands* or *other waters of the United States*. Each of these categories is described below.

USACE defines *wetlands* as areas that are inundated or saturated by surface water or groundwater at a frequency and duration that is sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3[b]; 40 CFR 230.3). For a wetland to qualify as a jurisdictional aquatic site, and therefore be subject to regulation under CWA Section 404, it must support a prevalence of hydrophytic vegetation, hydric soils, and wetland hydrology.

Other waters of the United States are water bodies that are regulated under Section 404 of the CWA but do not typically display all three of the wetland indicators identified above.

As stated in Chapter 3, *Description of Alternatives*, this document is intended to provide project-level CEQA and NEPA analysis for *CM1 Water Facilities and Operation*, and program-level analyses for all other BDCP covered activities. To support the approval of a water conveyance alternative at the project level, it will be necessary to consider its effects on wetlands and waters of the United States at a detailed level. This analysis will be part of the Section 404 Clean Water Act application process, as is needed to support compliance with the Act, and which must occur prior to issuing a Record of Decision for the project's 404 permit action under terms of NEPA. A jurisdictional wetlands determination has not been undertaken for other elements of the BDCP because more specific detail must be developed for individual conservation actions before a specific area of effect can be identified.

The wetland classification system used to delineate wetlands and waters of the United States for the analysis in this chapter is different from that used to develop natural communities in the BDCP. The BDCP natural communities development process and methods are described in Section 12.3.2.2, *Methods Used to Assess Natural Community Effects*. The method for mapping and quantifying potential wetlands and waters of the United States for this EIR/EIS was developed and implemented by DWR. Wetland mapping followed protocols developed for the Sacramento-San Joaquin Delta, which were adapted from the Bay Area Aquatic Resources Inventory (BAARI; San Francisco Estuary Institute 2011). DWR used an analysis of electronic geographic data using a GIS to delineate potential wetlands within the Conveyance Planning Areas. DWR interpreted digital aerial imagery from 2005–2010 to identify wetland vegetation and other aquatic features. Additional sources of information were also consulted including the CDFW GIS dataset showing vegetation and land use for the Sacramento San Joaquin Delta (Hickson and Keeler-Wolf 2007), digital elevation data (LiDAR), historical aerial imagery available on Google Earth, Natural Resource Conservation Service soil maps, and the USFWS National Wetland inventory maps.

Field data was collected at a limited number of accessible sites in support of this GIS-based determination. DWR environmental scientists conducted wetland delineations following the method in the *1987 Corps of Engineers Wetland Delineation Manual* (U.S. Army Corps of Engineers 1987) and the Arid West Supplement (U.S. Army Corps of Engineers 2008). DWR plotted the locations of the field wetland data points on the wetland map. Most data points confirmed the mapped wetland boundaries, but slight adjustments to wetland polygons were made if necessary. The wetland delineation was submitted to the USACE for verification in August 2014. The final verified delineation incorporated changes requested by the USACE.

Table 12-6 classifies the potentially jurisdictional wetland and other water types mapped in the Conveyance Planning Areas with the corresponding type from the Cowardin classification system (Cowardin et al. 1979). These wetland features are stored in a geographic feature class within a geodatabase. Descriptions of the mapped wetland types are included below.

Table 12-6. Wetlands and Other Waters of the United States

	Wetland/Water Type	Map Label Codes	Cowardin Code	Type in Draft EIR/EIS
Wetlands				
Perennial	Emergent	EM	PEM Palustrine-emergent	Tidal wetland and nontidal wetland
	Scrub-Shrub	SS	PSS Palustrine-scrub-shrub	Tidal wetland and nontidal wetland
	Forest	FO	PFO Palustrine-forested	Tidal wetland and nontidal wetland
Seasonal	Vernal Pool	VP	PEM2 Palustrine-emergent-nonpersistent	Seasonal wetland
	Seasonal Wetland	SW	PEM Palustrine-emergent	Seasonal wetland
	Alkaline Wetland	AW	PEM Palustrine-emergent or PSS Palustrine-scrub-shrub	Seasonal wetland
Other Waters of the United States				
Nontidal	Agricultural Ditch	AD	R4 Riverine-Intermittent	Nontidal flow
	Natural Channel	CH	R4 Riverine-Intermittent	Nontidal flow
	Depression	DE	PUB Palustrine-unconsolidated bottom	Pond or lake
	Lake	LA	L1UB Lacustrine-Limnetic unconsolidated bottom	Pond or lake
Tidal	Tidal Channel	TC	R1UB Riverine-Tidal-unconsolidated bottom	Tidal flow
	Conveyance	CO	N/A Concrete or rock-lined conveyance channels	Muted tidal flow
	Clifton Court Forebay	CCF	R1UB Riverine-Tidal-unconsolidated bottom	Clifton Court Forebay

Perennial Wetlands

Perennial wetlands are dominated by persistent hydrophytic vegetation. Three types of perennial wetlands were mapped in the Project Area based on the growth form of the vegetation. (The types below were designated as Tidal Wetlands or Nontidal Wetlands in the Draft EIR/EIS.)

Emergent Wetland

Emergent wetlands are dominated by emergent marsh plants such as tules and cattails, or native or ruderal hydrophytic herbaceous forbs. Nontidal emergent wetlands occur above the waterline in ditches or other nontidal channels, at the edge of ponds or lakes, or where seepage occurs on the landside of levees. Tidal emergent wetlands occur in the vegetated zone along tidal or muted tidal channels, in areas such as mud flats, waterside levee toes, and in-channel islands.

Scrub-Shrub Wetlands

Scrub-shrub wetlands are dominated by woody vegetation that is less than 6 m tall and includes riparian shrubs such as native blackberries, dogwoods, buttonbush, and California wild rose, as well as willow and cottonwood seedlings or saplings. Scrub-shrub wetlands may occur in depressions or other nontidal areas such as the banks of ditches and the edges of ponds or lakes. This plant community also occurs in tidally influenced areas along tidal channels and on in-channel islands.

Forested Wetlands

Forested wetlands are defined by woody vegetation that is 6 m tall or taller. Riparian trees in the study area include: Goodding's willow, arroyo willow, sandbar willow, and Fremont's cottonwood. Forested wetlands are found in areas with tidal and nontidal water regimes, as described for scrub-shrub wetlands.

Seasonal Wetlands

Three types of seasonal wetlands were mapped in the study area. Seasonal wetlands are usually dry for part of the year and therefore exhibit vegetation that is patchy or not persistent throughout the year. Strongly alkaline or saline conditions may also cause the soil to be barren of vegetation in some areas. (The types below were all designated as Seasonal Wetlands in the Draft EIR/EIS.)

Vernal Pool

Vernal pool wetlands are depressions with an impervious soil horizon close to the surface. These depressions fill with rainwater and may remain inundated through spring or early summer; they often occur in complexes of many small pools that are hydrologically interconnected. Vernal pools support distinct plant species adapted to the characteristic flooding and drying cycles of the habitat.

Seasonal Wetland

A type of seasonal wetland occurs in the central Delta within plowed agricultural fields. Although a system of pumps and drainage ditches controls water levels on the subsided islands, a high water table persists in some areas. Upland crops are planted in the surrounding fields but hydrophytic ruderal forbs become established in the wet areas, and crops usually fail if planted there. The vegetation in these wetlands consists of annual weeds that do not persist through the winter.

Alkaline Wetland

Alkaline wetlands are a type of seasonal wetland influenced by strongly alkaline or saline soils. Alkaline wetlands support alkaline or saline tolerant species such as iodine bush and alkali heath, but may also have large unvegetated areas that are seasonally ponded or saturated.

Nontidal Waters

In the Delta five types of nontidal waters were mapped as the open water portion of either naturally occurring features or unnatural features that were excavated and/or diked. Nontidal waters may occur in depressions of various sizes or in channels with either intermittent or perennially flowing water. The vegetation associated with these waters is discussed separately in the *Perennial Wetlands* and *Seasonal Wetlands* sections. (The types below were designated as either Nontidal Flow or Pond/Lake in the Draft EIR/EIS.)

Agricultural Ditches

Throughout the Delta there are many ditches constructed for the purpose of irrigating and/or draining agricultural land. The mapped ditches range in size from one to 22 meters wide. They are generally unvegetated with mud bottoms, but may support floating species such as duckweed or water hyacinth.

Natural Channels

Nontidal natural channels exist on the northeast and southwest edges of the Project Area. These include a section of the Cosumnes River and several small channels linking other water features. All of these features flow intermittently. The substrate in natural channels may be mud, or sand, gravel, and cobbles.

Depressions

Depressions are ponds that are permanently, seasonally, or artificially wet, with little to no rooted vegetation on a mud or sand bottom. They may be artificially filled or result from a high water table. Depressions are less than 20 acres in size with a depth of less than 2 meters. These water bodies are often created in grazing lands for use as stock ponds, and may be diked or otherwise artificially impounded.

Lakes

Lakes have characteristics similar to depressions, but are greater than 20 acres in size and may have a wave-formed shoreline.

Tidal Waters

Tidal waters are the open water portions of aquatic features that are influenced by the rise and fall of the tides. Man-made structures such as gates or culverts may restrict tidal influence to various degrees. The vegetation associated with these waters is discussed separately in the *Perennial Wetlands* and *Seasonal Wetlands* sections.

Tidal Channels

Tidal channels may be naturally occurring perennial riverine waterways, though most have been modified with leveed banks and often reinforced with rock revetment. Water velocity and depth fluctuates under tidal influence, and the channel bottom is generally comprised of mud or sand. Tidal channels that have been created by excavation are usually straight rather than sinuous, and usually have heavily diked or reinforced banks. These excavated channels were often created to provide for navigation, water conveyance, material for levees, or to raise the land surface on adjacent property. Tidal channels are largely unvegetated, or may support floating or submerged aquatic vegetation.

Conveyance Channels

Several large rock-lined conveyance channels were mapped in the study area. These constructed water features were mapped along with all other aquatic resources in the Project Area because they may be subject to some tidal effects and therefore may be considered jurisdictional by USACE. (This type was designated as Muted Tidal Flow in the Draft EIR/EIS.)

Clifton Court Forebay

Clifton Court Forebay, a constructed reservoir, is a highly modified perennial water body which is semi-enclosed by land, and engineered to be periodically open to tidal influences via a moveable gate structure. The Forebay is characterized by an artificial rock shore (rock revetment) and an aquatic bed of varying depths. The forebay is largely unvegetated, however, emergent perennials such as cattails and tules are found in shallow areas, and submerged aquatics such as Brazilian waterweed are found in areas of moderate depth.

The features of the action alternatives include canals, tunnels intakes, forebays, pumping plants, staging areas, and borrow and spoil areas and are considered to have either permanent or temporary impacts. These features are stored in a geographic feature class within a geodatabase and were used to determine the surface impact for each alternative.

To determine effects resulting from CM1 construction, the GIS layer of potentially jurisdictional wetland and other waters was intersected with the layer of project footprint surface features for each proposed EIR/EIS alternative. The resulting polygons identify the areas of potential impacts on jurisdictional waters. Acreages of each type of impacted wetland were calculated for each alternative and are presented in the wetlands and waters of the United States impact discussions in Section 12.3.3, *Effects and Mitigation Approaches*, and Section 12.3.4, *Effects and Mitigation Approaches—Alternatives 4A, 2D, and 5A*.

The GIS data layer of wetlands and other waters of the United States used in this process includes all potentially jurisdictional waters, including those waters that may be later determined by USACE to be isolated or otherwise non-jurisdictional. Although some potential wetlands may not have been identified in areas where hydrology is extensively manipulated by agricultural activity, the use of this methodology and the GIS data layer likely results in an overestimation of the wetlands and waters that would be affected and would require permitting. The actual construction footprints are expected to be smaller than design footprints, including the large intake footprints extending into the Sacramento River. Also, the GIS methodology used to assign a footprint to the transmission corridors involved creating a continuous band of effect along the entire alignment rather than attempting to place individual transmission tower footprints along the alignment. Finally, the potential jurisdictional wetlands mapping included a delineation of all agricultural-related ditches and canals; some of these waterways are likely to be determined non-jurisdictional during the permitting process.

The habitat protection and restoration activities associated with other BDCP conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and waters of the United States in the study area through the course of the BDCP protection and restoration program. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures (CM2, CM4, and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in Chapter 5 of the BDCP. These theoretical footprints have been used to predict the acres of natural communities that would be affected through loss or conversion, which gives some indication of jurisdictional wetland effects. Any CM2–CM10 effects ascribed to tidal perennial aquatic, tidal brackish emergent, tidal freshwater emergent, other natural seasonal, nontidal freshwater perennial emergent, and nontidal perennial aquatic wetlands natural communities are likely to also be effects on wetlands and other waters of the United States. Effects ascribed to other natural communities and land cover types with small jurisdictional wetland components (valley/foothill riparian, alkali seasonal wetland complex, vernal pool complex, managed wetland, grassland and cultivated lands) are not easily converted to effects on wetlands and other waters of the United States by the use of theoretical footprints. Because of this lack of detail, a programmatic assessment is provided for these other conservation measures. In the programmatic impact analysis, it has been assumed that 100% of the predominantly wetland natural communities mentioned above and 10% of all of the non-wetland natural communities mentioned above would qualify as wetlands or other waters of the United States under the CWA.

Relationship to Waters of the State

As noted in Section 12.2.2.7, *Porter-Cologne Water Quality Control Act*, waters of the state includes "any surface water or groundwater, including saline waters, within the boundaries of the state", which is a broader definition than that of waters of the United States (see Section 12.2.1.1 *Sections 404 and 401 of the Clean Water Act*). As discussed above, DWR's delineation of waters of the United States includes all potentially jurisdictional waters, including those waters that may be later determined by USACE to be isolated or otherwise non-jurisdictional (e.g., agricultural ditches and canals). Because DWR's delineation did not exclude any such wetlands and waters, the delineation also represents what would be considered waters of the state within the Plan Area. Therefore, the analyses and conclusions for effects on waters of the Unites States in Sections 12.3.3 and 12.3.4 under Impact BIO-176: *Effects of* Constructing *Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States* and Impact BIO-177: *Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States* would also apply to waters of the state.

12.3.2.5 Methods Used to Consider Mitigation

The potential environmental effects of each project alternative have been analyzed independently below. In many cases, the potential effects on individual natural communities or special-status species created by each project element (the Conservation Measures/Environmental Commitments) have also been independently identified. In most cases, these independent effects have been compiled into a summary conclusion. All effects identified as adverse and potentially significant have been evaluated for the feasibility of mitigation after first considering whether avoidance and minimization measures (AMMs) and the conservation measures built into the BDCP would lessen the significant adverse environmental effects. Permanent and temporary impacts have been treated the same in considering the need for mitigation.

To consider AMMs as a source of avoiding or reducing effects, each AMM was reviewed for its relevance to the impact (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, for a full list of AMMs). If the measure was deemed capable of avoiding or reducing significant impacts, it was identified in the analysis.

The second consideration was the near-term and long-term protection and restoration activities contained in BDCP conservation measures and biological goals and objectives (BGOs). Each of these activities was reviewed for its relevance to the effect. Where relevant, the magnitude of each protection and restoration activity was considered in relation to the potential effect. Where the potential for significant environmental effects remained despite the conservation measures and AMMs, specific mitigation measures were identified.

The BDCP includes a net effects analysis that estimates beneficial effects of the Plan (see BDCP Chapter 5, *Effects Analysis,* Tables 5.6-7 and 5.6-8). This net effects analysis was reviewed in the process of developing the EIR/EIS analyses. However, the firm commitments of the conservation measures and BGOs in the BDCP were the principal elements in developing CEQA and NEPA conclusions. Where BDCP effects are related to construction of the water conveyance facilities and are likely to involve site-specific protection or restoration activities, the text refers the reader to Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*. This appendix contains an analysis of the BDCP's near-term conservation measures and their ability to offset the effects of water conveyance facilities construction on terrestrial biological resources. The analysis includes a consideration of the feasibility of the restoration and protection actions in light of the project-specific level of analysis that has been conducted for the water conveyance facilities. The content of Appendix 12D has been closely coordinated with the monitoring and adaptive management program developed for the BDCP.

The process used in Appendix 12D to determine whether the BDCP near-term protection and restoration actions would sufficiently offset water conveyance facilities' effects on natural communities includes an initial comparison of water conveyance facilities' near-term effects with the total near-term natural community protection and restoration goals contained in the Plan (see Tables 12D-9 to 12D-13 in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*). Because a project-level of analysis has been applied to the water conveyance element of the Plan, the comparison has also been made between a typical project-level mitigation ratio for the natural community and the near-term protection and restoration goals. If these goals meet or exceed the typical project-level mitigation requirement, and if the BDCP includes a commitment to timely conservation actions that address any loss in habitat value during the near-term timeframe, the conservation actions have been considered sufficient to offset the effect. The timeliness of conservation actions has been judged independently for each natural community. The Biological Goals and Objectives outlined in BDCP Chapter 3, *Conservation Strategy*, have also been reviewed for more specific information that has been developed to guide protection and restoration actions. The general availability of lands to be used as compensation for water conveyance effects has also been evaluated in Appendix 12D.

The process used in Appendix 12D to determine whether BDCP near-term conservation actions would sufficiently offset water conveyance effects on special-status wildlife and plants is similar to that for natural communities, except that effects are described in terms of modeled habitat lost. These losses have been compared with the BDCP planned conservation of natural communities that make up that modeled habitat and the BDCP goals and objectives that specify the timing, location and nature of habitat improvements needed to offset effects on special-status species. As with natural communities, the appropriateness of the timing of conservation actions is also considered in determining the sufficiency of near-term offsets.

The typical mitigation ratios contained in Tables 12D-9 to 12D-13 in Appendix 12D have been used only for analytical purposes in the EIR/EIS to determine the sufficiency of the BDCP conservation strategy as CEQA and NEPA mitigation (i.e., whether the BDCP conservation strategy includes sufficient land acquisition and restoration to adequately mitigate the impacts of CM1 for purposes of CEQA and NEPA). These ratios reflect and are consistent with the professional judgment and scientific knowledge of the biologists who worked on this chapter and the BDCP, and reflect their collective experience in environmental permitting, preparation of HCPs/NCCPs and similar natural resource management plans, and preparation of CEQA documents for state, regional, and local agencies. It is recognized that there is a sizeable range in mitigation ratios used in environmental documents. The ratios generally depend on level of ecological function lost and level of confidence in the ability of the mitigation measures to replace that function. Given that many of the impacts of implementing the BDCP would occur on degraded habitats and the BDCP conservation measures include commitments to specific performance standards, the ratios used in this chapter are considered reasonable.

Mitigation ratios were not used to develop the BDCP conservation strategy for purposes of complying with ESA or NCCPA; therefore, these mitigation ratios are not mentioned in BDCP Chapter 3, and would not be used to ensure plan compliance with those two statutes. Instead, compliance with ESA and NCCPA would be determined by ensuring rough proportionality between effects and conservation as a whole.

The typical mitigation ratios used in Appendix 12D take into account several factors typically used during project-level evaluations.

- The sensitivity and rarity of natural communities. More sensitive or rare communities have higher ratios.
- The importance of natural communities as habitat for the covered species. Communities that support more covered species have higher ratios.
- Threats to the natural community and the need for preservation to help alleviate those threats. Communities with more threats have a higher preservation ratio.
- The uncertainty in the success of restoration efforts, including evidence in other areas that similar restoration works. Communities with more uncertain restoration have a higher restoration ratio.

The difference between the land acquisition and restoration needed to offset construction effects and that needed for the entire conservation strategy should not alone be viewed as the BDCP's contribution to recovery (i.e., beyond mitigation). There are many additional components of the conservation strategy not captured in this analysis that also conserve the covered species and contribute to their recovery. For example, enhancement and management of natural communities

(CM11), which involves creating specific vegetation structure or composition, would also help to conserve covered wildlife and plants. See the biological goals and objectives in Section 3.3 of the BDCP for a full description of all Plan requirements that would help to conserve the covered species. The numeric targets for natural community acquisition and restoration are only a part of those requirements.

As discussed above, offsets for impacts on terrestrial biological resources generally take the form of accelerated efforts to restore or protect similar biological resources as part of the overall conservation plan. The proposed timing of these restoration and protection measures are documented (in 5-year increments) in Chapter 3, Table 3-4, of this document, and in BDCP Chapter 6, Table 6-2. The authors of this chapter have compared the restoration and protection timing indicated in these tables with the anticipated timing of construction and restoration that might eliminate habitat. Although it would be desirable from a habitat-availability perspective to have the restoration and protection offsets in place simultaneously with the occurrence of impacts (this is not a regulatory requirement), in some instances there may be short-term lag times between the occurrence of the impacts, and the maturation of restored habitats and protection and enhancement of existing habitats. As specified in Chapter 6, Section 6.1.2 of the BDCP, in order to meet the NCCPA requirement for rough proportionality, the Plan commits to pace the implementation of the conservation measures such that they may not fall behind the pace of covered activity impacts by more than 10%. Such short-term delays have been accounted for in the formulation of offset strategies such as the use of ratios for restoration or protection. Except where specifically noted in impact discussions later in this chapter, such minor delays should not by themselves lead to short-term or permanent adverse or significant impacts. Because of the availability within the study area of like habitats to sustain affected species until the offset lands are fully functional, in only a few instances, identified in specific impact discussions below, would such delays lead to short-term adverse or significant effects on species. For example, although there may be short-term delays in the creation of restored wetlands, the species that inhabit the impacted wetlands would persist in other wetlands available within the study area until offset lands are functional. Except where specifically noted later in this chapter, these short-term losses are not expected to be adverse or significant because the acreages involved would be relatively small compared with total suitable habitat within the study area and because the short-term losses would primarily be associated with lower value habitat. In addition, restoration under CM2 through CM11 would offset these losses with higher value habitats.

12.3.3 Effects and Mitigation Approaches

12.3.3.1 No Action Alternative

The No Action Alternative describes expected future conditions for terrestrial biological resources resulting from a continuation of existing policies and programs by federal, state, and local agencies in the absence of the action alternatives. As described in Chapter 3, *Description of Alternatives*, the No Action Alternative analysis takes into consideration Existing Conditions, programs already adopted during the early stages of development of the EIR/EIS, facilities that were permitted or under construction during the early stages of development of the EIR/EIS, and foreseeable changes in land and water management associated with existing plans, policies and legal mandates that would occur with or without the project. The assumptions that are included in the No Action alternative are further defined in Appendix 3D*, Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*. The appendix includes an extensive list of existing programs, projects and policies that should be considered in all resource analyses (Tables 3D-2 and 3D-A.). An additional list of programs, projects and policies that were in the process of being implemented during the early stages of EIR/EIS development and that have been considered under the No Action Alternative are listed in Table 3D-4. These lists have been reviewed as they relate to terrestrial biological resources; the projects and programs listed in Table 12-7 are considered the most relevant to the No Action Alternative discussion in this chapter.

For this analysis, it has been assumed that the urban land uses in the study area would be only slightly modified from those of today because only limited types of development are allowed in the Primary Zone of the Delta, and urban expansions in the remainder of the study area are difficult to predict, given the strong influence of economic conditions and local planning restrictions. Two relatively large proposed urban developments, Mountain House northwest of Tracy and River Islands, west of Lathrop, are known and have the potential to remove over 7,200 acres of agricultural land in the southern portion of the study area. There is also the potential that urban expansion in the lands surrounding the study area could either directly or indirectly affect the terrestrial biological resources in the study area.

Table 12-7. Programs, Projects, and Policies Included In No Action Alternative for the Terrestrial Biological Resources Analysis

Agency	Program/Project/Policy	Comments
Alameda County	East Alameda County Conservation Strategy	Approved in 2011. There is less than a 2% overlap with BDCP and this overlap only occurs in one conservation zone. Currently no planned conservation activity in the overlap area.
California Department of Fish and Wildlife	Calhoun Cut/ Lindsey Slough Restoration	Increase intertidal marsh habitat and adjacent riparian habitat on 927 acres in Cache Slough ROA.
California Department of Fish and Wildlife	Ecosystem Restoration Program Conservation Strategy	Created in 2000. Ongoing program to preserve, restore, and enhance terrestrial natural communities and ecosystems in the San Francisco Bay and Sacramento-San Joaquin Delta. Protected and restored more than 150,000 acres of habitat, including 3,900 acres and 59 miles of riparian and riverine aquatic habitat (as of 2010) after 7 of the planned 30 years of the project.

Agency	Program/Project/Policy	Comments
California Department of Fish and Wildlife	Fremont Landing Conservation Bank	Established in 2006. Enhances 40 acres of riparian habitat and restores 60 acres of riparian woodlands and sloughs.
California Department of Fish and Wildlife	Grizzly Island Wildlife Area Land Management Plan	Estuarine marsh that contains about 15,300 acres of wildlife habitat. Will continue to be managed for wildlife.
California Department of Fish and Wildlife	Lower Sherman Island Wildlife Area Land Management Plan	Ongoing program. Directs habitat and species management on 3,100 acres of marsh and open water.
California Department of Fish and Wildlife	Private Lands Incentive Program	Includes 29,000 acres of habitat in Tulare Basin, Grasslands, Suisun Marsh, and Sacramento Valley. Encourages development and enhancement of habitat for shorebirds and waterfowl on private lands.
California Department of Fish and Wildlife	Restoring Ecosystem Integrity in the Northwest Delta	Originally funded in 2004. Ongoing program. Focused on habitat restoration. Currently concentrating acquisition efforts on 3 specific properties consisting of about 150 acres and baseline monitoring.
California Department of Fish and Wildlife	Staten Island Wildlife-Friendly Farming Demonstration	Ongoing program. Objective is ecosystem restoration; 2,500–5,000 acres of corn will be flooded to increase habitat availability and to improve wildlife-friendly agriculture to foster recovery of at-risk species and to investigate effects of agriculture on water quality.
California Department of Fish and Wildlife	Yolo Bypass Wildlife Area Land Management Plan	Ongoing program. Provides for multiple use management of 16,000 acres of mixed agricultural, grassland and managed wetland habitats.
California Department of Water Resources	Delta Levees Flood Protection Program	Ongoing program. Includes modification to Delta levees within the Sacramento-San Joaquin Delta and portions of the Suisun Marsh. The project works with 60 reclamation districts and strives to complete levee rehabilitation projects with no net loss of habitat in the Delta.
California Department of Water Resources	Levee Repair-Levee Evaluation Program	Ongoing program. Upgrading levees along the Sacramento and San Joaquin Rivers and Delta; 1,600 miles of levees included in Central Valley.
State and Federal Water Contractors	Lower Yolo Restoration Project	In Cache Slough ROA, reintroduce tidal action to half of 3,408-acre Yolo Ranch.
California Department of Water Resources	Dutch Slough Tidal Marsh Restoration Project	Converts 240–840 acres from agricultural uses and grazing to wetland, riparian, and upland habitats.
California Partners in Flight	Riparian Habitat Joint Venture	Ongoing program. Promotes and supports riparian conservation and enhancement, contributes to flood control and maximizes habitat available to wildlife. Protects and restores riparian areas with intact adjacent upland habitats.
Central Valley Joint Venture Program	Central Valley Joint Venture	Ongoing program. Strives to protect, restore, and enhance wetlands. Contributes to habitat conservation on a total of 714,000 acres in California.

Agency	Program/Project/Policy	Comments
Contra Costa County and East Contra Costa County Habitat Conservancy	East Contra Costa County HCP/NCCP	Approved in 2007. Encompasses about 175,000 inventory acres and contains 30,000 acres of preserved land. Purpose is to purchase, restore, and permanently protect large, interconnected and biologically rich blocks of habitat. Occurs almost entirely out of the BDCP boundary.
Contra Costa Water District	Contra Costa Canal Fish Screen Project	Completed in 2011. Designed to restore Delta ecosystems. Minor terrestrial impact at fish screen sites.
Contra Costa Water District, U.S. Bureau of Reclamation, and California Department of Water Resources	Contra Costa Water District's Middle River Intake and Pump Station (Alternative Intake Project)	Completed in 2010. Resulted in permanent conversion of 6–8 acres of rural agricultural land. Features about 12,000 feet of pipe across Victoria Island and under Old River.
National Marine Fisheries Service, U.S. Bureau of Reclamation, and Department of Water Resources	Biological Opinion on the Long-Term Operations of the Central Valley Project and State Water Project	Ongoing program. Action area consists of the Oroville Reservoir, Feather River downstream of Oroville, Sacramento River downstream of Feather River, Sacramento-San Joaquin Delta, and adjacent habitats that are dependent on or influenced by waterways. Designed to conserve freshwater, estuarine, nearshore, and offshore sites. Includes 8,000-acre tidal wetland restoration requirement.
Reclamation District 2093	Liberty Island Conservation Bank	Under implementation. Permits and approvals acquired in 2009. Project site is on northern tip of Liberty Island, within the southern area of the Yolo Bypass where it flows into the northwest Sacramento/San Joaquin River Delta. Over 160 acres in the project site with about 50 proposed to be converted to open water channels, emergent marsh wetland, and riparian habitat. Focuses on Delta fish habitat but will restore 2.7 acres of riparian habitat.
Sacramento Area Flood Control Agency, Central Valley Flood Protection Board, and U.S. Army Corps of Engineers	Flood Management Program	Ongoing program. Supports flood management planning in Sacramento and San Joaquin Valleys. To be updated every 5 years with first update to be completed in 2017. Combined total of about 2.2 million acres of land within the Central Valley.
San Joaquin Council of Governments	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan	Ongoing program. Approved in 2011. Includes most of San Joaquin County. Assumes 100,000 acres of open land conversion and provides about 100,000 acres of preserves. About 35% of this plan overlaps with BDCP so competition for restoration sites and land acquisition would exist. There are 39 covered species in common and very similar land acquisition targets, such as riparian forests and grasslands.
U.S. Army Corps of Engineers	CALFED Levee Stability Program	Includes maintaining and improving levee stability in the Delta. Long-term strategy will include ecosystem restoration. Partially funds McCormack-Williamson Tract Restoration in Cosumnes-Mokelumne ROA; 1,500 acres of tidal and floodplain restoration.

Agency	Program/Project/Policy	Comments
Bureau of Reclamation	Delta Mendota Canal/ California Aqueduct Intertie	Construction completed in April 2012. Includes construction of a pump and 500-foot pipeline between the two canals near the Jones Pumping Plant. No special-status plant community affected.
Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Department of Water Resources and Department of Fish and Wildlife	San Joaquin River Restoration Program	Initiated in 2006. Ongoing program; 150 miles of the river is planned for restoration, including within the BDCP Plan Area.
U.S. Fish and Wildlife Service, Bureau of Reclamation and California Department of Fish and Wildlife	San Joaquin Basin Action Plan	Includes a habitat acquisition and wetland enhancement project on 23,500 acres in northern San Joaquin River basin.
U.S. Fish and Wildlife Service	Recovery Plan for Sacramento-San Joaquin Delta Native Fishes	Includes developing additional shallow water habitat, riparian vegetation zones and tidal marsh to restore wetland habitats throughout the Bay-Delta ecosystem.
U.S. Fish and Wildlife Service	Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan	Drafted in 2006. Ongoing program. Directs habitat and species management on 17,600 acres of grassland, managed wetland and riparian habitat.
U.S. Fish and Wildlife Service, Bureau of Reclamation, and Department of Water Resources	Biological Opinion on the Long-Term Operations of the Central Valley Project and State Water Project (Delta smelt)	Ongoing program. Directs restoration of at least 8,000 acres of intertidal and related subtidal habitat for delta smelt in the Delta and Suisun Marsh.
Zone 7 Water Agency and Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Under construction. Estimated completion in 2012. More than 40 miles of pipelines and a 500 acre-foot reservoir will be built. No significant effects expected to terrestrial biology habitats.

Effects on Terrestrial Natural Communities

Changes to land use and land management have the greatest potential to affect terrestrial natural communities and land cover types in the study area if the current water management policies and activities associated with the plans and programs in Table 12-7 continue in the absence of the action alternatives. Under the No Action Alternative, local, state and federal programs to preserve open space and agricultural lands would continue to be implemented, as described in Chapter 13, *Land Use*. The management of state- and federally owned wildlife areas, including Grizzly Island, Sherman Island and Yolo Bypass State Wildlife Areas, and Stone Lakes NWR, would continue to focus on multiple uses, including wildlife habitat improvement, public access for wildlife viewing, wildlife-friendly agricultural production and hunting opportunities. These areas are primarily managed wetlands and cultivated land, with smaller areas of tidal and nontidal wetlands, grassland and small linear patches of valley/foothill riparian habitat. These areas will continue to be managed and enhanced to benefit both special-status and common wildlife that use these natural communities. The many privately owned managed wetlands would continue to support primarily wintering waterfowl and associated aquatic and terrestrial species. The urban and infrastructure land uses in the Delta would be only slightly modified from those of today for the reasons stated above. Any urban expansion would likely be on the periphery of existing towns and cities and would result in the gradual removal of primarily cultivated land and nonnative grassland.

A continuation of current water management strategies used by state, federal and local water purveyors would not significantly modify the principal natural communities in the study area. Periodic levee and channel maintenance activities associated with current strategies would result in localized disturbances to valley/foothill riparian, grassland and tidal perennial aquatic natural communities, and to a lesser extent to tidal brackish and tidal freshwater emergent wetlands. To the extent that ongoing levee repair and replacement involves use of reinforcing rock and discouragement of replanting streamside vegetation, there could be a gradual decline in the extent and value of valley/foothill riparian habitat and grassland along minor and major waterways. Several of the water management projects listed in Table 12-7 require localized removal of natural communities and agricultural land for expanding infrastructure. Most of these activities are on the periphery or just outside of the study area, including the Contra Costa Water District fish screen and diversion structure modifications, the Delta Mendota Canal/California Aqueduct intertie project, and the South Bay Aqueduct improvement project.

There are many programs either under way or in the planning stages to increase wetland and riparian habitats in the study area. Some of the larger programs are listed below.

- DWR Dutch Slough Tidal Marsh Restoration Project (1,165 acres to wetlands and uplands).
- State and federal water contractors’ Lower Yolo Restoration Project (3,408 acres of tidal and riparian restoration on Yolo Ranch)
- USFWS/Reclamation/DFG San Joaquin Basin Action Plan (23,500 acres of land acquisition and wetland enhancement).
- USFWS Recovery Plan for Sacramento-San Joaquin Delta native fishes (creation of shallow water habitat, riparian vegetation, tidal marsh).
- CDFW Lower Sherman Island Wildlife Area Land Management Plan (3,100 acres of marsh and open water management).
- CDFW Yolo Bypass Wildlife Area Management Plan (16,000 acres of managed agricultural, wetland, grassland and vernal pool complex habitat).
- CDFW Grizzly Island Wildlife Area Management Plan (15,300 acres of estuarine marsh managed for waterfowl and wetland habitats).
- USACE McCormack-Williamson Tract Restoration (1,500 acres of tidal restoration in the east Delta).
- USFWS Stone Lakes Wildlife Refuge Management Plan (18,000 acres of managed agricultural, wetland, grassland and riparian habitats).

Ongoing implementation of these plans and programs would result in some decline of cultivated lands in the study area. There are also plans, however, to continue and expand partnerships with agricultural interests to manage croplands for wildlife-friendly crops.

In the longer term, both gradual and catastrophic natural phenomena could affect the mix of open water, tidal wetland, agricultural and riparian forest natural communities in the study area through continued land subsidence on Delta islands, levee degradation and potential failure from floods or seismic events, and climate change (see Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*). Based on trends in land use conversions in the Delta during recent years, these natural changes would result in the conversion of additional cultivated land and possibly managed wetlands to tidal wetlands and open water.

Effects on Special-Status and Common Wildlife and Plants

The gradual conversion of cultivated land, managed wetland and grassland in the study area, and the loss of Delta island habitat to inundation due to levee failure, have the potential to affect specific special-status and common wildlife and plants, depending on the location of these effects. Loss of certain types of cultivated land could reduce foraging habitat for nesting raptors, including Swainson's hawk and white-tailed kite, and for over-wintering waterfowl and wading birds, including greater sandhill crane, greater yellow-legs, snow goose and northern pintail. A large variety of wintering waterfowl and shorebirds rely on harvested rice and corn fields for a food source. Managed wetlands serve a similar function. An expansion of tidal wetlands would provide benefits to species such as salt marsh harvest mouse, California black rail and California clapper rail. Flooding of Delta islands would result in additional cultivated land losses and would not provide significant benefit to most terrestrial species, as the study area does not have a shortage of open water habitat.

Effects of Global Climate Change on Terrestrial Biological Resources

Under the No Action alternative, global climate change is expected to result in many physical changes to the Plan Area. From a terrestrial biology perspective, the most significant changes would include a gradual rise in sea level, increasing water and air temperatures, more frequent drought and extreme rainfall events, and changes in the hydrologic patterns of the rivers and the Delta channels that influence the terrestrial and aquatic habitats used by terrestrial plants and wildlife. The climate change analysis included in Chapter 29 considers sea level increases at levels ranging from 18 to 55 inches (see Chapter 29, *Climate Change*, Section 29.5.1.2). Air temperatures are projected to rise by 2–5 degrees F by 2050 and water temperatures are projected to increase as some proportion (2–3 degrees F) of the air temperature rise (see Appendix 29C, *Climate Change and the Effects of Reservoir Operations on Water Temperatures in the Study Area*, Section 29C.2.1). The changed frequency of drought and extreme rainfall events has not been predicted, but is expected to be a factor in future California conditions with global climate change. Hydrologic conditions in the rivers and Delta channels are expected to be altered by changes in precipitation patterns, with a portion of precipitation shifting from snow to rainfall in the winter months. This would increase river flows in winter and early spring, and decrease flows in the remainder of the year as snowmelt runoff decreases. The changes in river flows would generate subsequent changes in west Delta and Suisun Marsh salinity levels.

The physical changes in conditions in the study area related to the climate change described above, especially the sea level rise, would change the distribution and value of study area habitats. Sea level rise is expected to gradually inundate existing habitats on the periphery of the Delta, in the lower Yolo Bypass, in the Cache Slough/Lindsay Slough area, and the northern and southern edges of Suisun Marsh. A potential pattern of inundation, which assumes a 55 inch sea level rise, is shown graphically in Figure 29-1. The effects of climate change on the Plan Area's natural communities and special-status species are discussed in detail in Appendix 5.A.1, *Climate Change Implications for Natural Communities and Terrestrial Species*, of the BDCP.

Tidal brackish and freshwater marsh in Suisun Marsh, the Lindsay Slough/Cache Slough area, and the lower Yolo Bypass could be gradually inundated and converted to more subtidal habitat. In areas where there is no upland barrier (levees, roads, residential development, agricultural fields), some portion of the tidal marsh may re-establish upslope with the higher water levels, if there is sufficient sediment available to provide an appropriate substrate. However, decreases in sediment availability that have occurred in the Delta and Suisun Marsh over time and that may continue, may not keep pace if the higher estimated rates of sea level rise occur (Barnard et. al 2013). The result could be a gradual loss of these tidal marshes in these parts of the study area. Where barriers exist upslope of existing marsh, the tidal marsh habitat could be gradually inundated and subtidal areas would remain. Subtidal habitat is less valuable to the special-status and common terrestrial plants and wildlife of the study area, including ground-nesting birds such as California black rail. Low-lying upland grassland, seasonal wetlands and riparian areas could also be gradually converted to tidal marsh, but would be expected to re-establish upslope where open ground exists and there are no physical barriers. Where these incursions bisect existing wildlife corridors, the ability of certain species to move and interact with adjacent populations would decrease. Population numbers of riparian, grassland and tidal marsh species would be likely to decrease and population distribution would be altered. The habitats adjacent to study area waterways would also be exposed to more frequent inundation and desiccation as precipitation levels show greater fluctuation.

In the Delta, where more of the land is separated from tidal action by man-made levees, sea level rise would be likely to affect narrower bands of habitat along the inside of these levees as there is a vertical rise in tidal levels. These narrow bands of habitat include grassland, riparian areas of willow and brambles, and tidal freshwater marsh. There are few areas in the Delta where the land gradually slopes away from tidal channels, allowing for some migration of tidal marsh upslope as water levels gradually rise. These areas are more likely to eventually be converted to subtidal habitat. As with Suisun Marsh and the lower Yolo Bypass, population numbers of riparian, grassland and tidal marsh species would be likely to decrease and population distribution would be altered.

Appendix 5A.1, *Climate Change Implications for Natural Communities and Terrestrial Species*, of the BDCP describes potential effects of climate change on specific covered species. Under the No Action Alternative, gradual warming of the environment, sea level rise and a shorter rain season would place added stress on wetland habitats, especially those under tidal influence. Special-status plants such as the Suisun marsh aster, Mason's lilaeopsis and Delta tule pea may see a shrinking of suitable habitat as tidal marsh is inundated. Wetland-associated birds, including California black rail, California clapper rail, Suisun song sparrow and tri-colored blackbird may lose nesting and foraging habitat to shrinking tidal marsh in the study area. Shortened rainy seasons may reduce late spring and summer habitats for aquatic species such as giant garter snake, California tiger salamander and western pond turtle.

Land subsidence, sea level rise, gradual or catastrophic levee failure, or a combination of these conditions, should they occur, would result in flooding and inundation that could significantly damage existing facilities and infrastructure, uproot and kill vegetation to an unknown extent, permanently flood Delta islands, and drastically alter the salinity of Delta waterways and wetlands. Depending on the extent and duration of flooding, significant short- and long-term changes could occur in the availability of shallow tidal wetlands, riparian and grassland habitats and managed lands useful to certain special-status and common species (e.g., cultivated land, managed wetland).

Depending on the amount of human intervention to drain islands and rebuild levees, there may be a gradual succession of habitats less valuable to the plant and animal species currently relying on the Delta for growth and seed production, cover, breeding, nesting, resting, movement corridors and foraging. Refer to Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*, for a further discussion of seismic and climate change effects that might occur in the study area under the no action condition.

As described in Chapter 3, *Description of Alternatives*, many of the ongoing programs that influence the study area include development of future projects that would require additional project-level environmental review. Future federal actions would be required to comply with NEPA, ESA, and other federal laws and regulations. Future state and local actions would be required to comply with CEQA, CESA, and other federal, state and local laws and regulations. Compliance and permit requirements would be implemented on a case-by-case basis.

NEPA Effects: The overall direction of existing and ongoing programs and policies that influence land conversion and land management in the study area is toward maintaining the mix of agricultural, recreational, water management, and wildlife uses that make the Delta, Yolo Bypass and Suisun Marsh valuable resources for the entire state. Some actions that will be taken in the absence of a BDCP will continue to expand natural and manmade terrestrial and wetland habitats that will either benefit or have no effect on the special-status and common plants and wildlife with habitat in the study area. These activities may also result in impacts to some species but the overall benefit of these activities would not be adverse for many species in the near-term. There is the potential, however, for long-term trends in levee deterioration, global climate change, and seismic activity that could damage levees and result in significant changes in natural communities and cultivated lands by the late long-term time period. Major changes in tidal and nontidal wetland, riparian, managed wetland, and cultivated land habitats would be an adverse effect on most terrestrial biological resources by the late-long term, although for some species, especially those that occur in the study area at higher elevations, there may be no effect or these effects would not be adverse (see Table ES-8 in the *Executive Summary*).

CEQA Conclusion: Under the No Action Alternative, existing plans, programs and policies would affect terrestrial biological resources in the study area in a mostly positive way. Many plans and programs call for expanded development and management of wetland and riparian habitats and increased management of cultivated lands for joint benefit to the farmer and wildlife. The implementation of these plans and programs could also impact some terrestrial biological resources, although on balance impacts would be offset by habitat improvements so that the plans and programs would result in less-than-significant impacts under CEQA in the near-term.

In the longer term, there are risks associated with natural processes that could damage or destroy Delta levees that protect both natural habitats and agricultural lands. The risks include flood-related levee deterioration, potential for seismically induced levee collapse, and sea level rise associated with climate change. These long-term risks, if unchecked, could result in a significant impact on the terrestrial biological resources of the study area by the late-long term, although for some species, especially those that occur in the study area at higher elevations, there may be no impact or the impact may be less than significant by the late-long term (see Table ES-8 in the *Executive Summary*).

12.3.3.2 Alternative 1A—Dual Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario A)

Section 3.5.2 in Chapter 3, *Description of Alternatives*, provides details of Alternative 1A, and Figure 3-2 depicts the alternative.

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance, and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal or modification of this community (see Table 12-1A-1). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the tidal perennial aquatic natural community (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4)
- Within the restored and protected tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4)
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13)

There is a variety of other, less specific conservation goals and objectives in the BDCP that would improve the value of tidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to AMMs, impacts on tidal aquatic natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Note that two time periods are represented in Table 12-1A-1 and the other tables contained in the analysis of Alternative 1A. The near-term (NT) acreage effects listed in the table would occur over the first 10 years of Plan implementation. The late long-term (LLT) effects contained in these tables represent the combined effects of all activities over the entire 50-year term of the Plan. This table and all impact tables in the chapter include reference to only those conservation measures that would eliminate natural community acreage either through construction or restoration activities, or that would result in periodic inundation of the community.

Table 12-1A-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	48	48	133	133	0	0
CM2	8	8	11	11	9–36	0
CM4	11	18	0	0	0	0
CM5	0	2	0	5	0	39
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**67**	**76**	**144**	**149**	**9–36**	**39**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently affect an estimated 76 acres and temporarily remove 149 acres of tidal perennial aquatic natural community in the study area. These modifications represent less than 1% of the 86,263 acres of the community that is mapped in the study area. The majority of the permanent and temporary effects would happen during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 8,300 acres of tidal wetlands, including an estimated 3,400 acres of tidal perennial aquatic natural community during the same period, which would expand the area of that habitat and offset the losses. The 3,400-acre increase is estimated, based on modeling reported in BDCP Appendix 3.B, Table 5, by comparing existing Plan Area subtidal habitat to near-term subtidal habitat with the Plan. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.1.2) indicates that, while there would be no minimum restoration requirement for the tidal perennial aquatic natural community, an estimated approximately 27,000 acres of tidal perennial aquatic natural community would be restored based on tidal restoration modeling. This estimate is based on Table 5 in BDCP Appendix 3.B, subtracting late long-term without project acreage from late long-term acreage with project acreage.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 48 acres and temporarily remove 133 acres of tidal perennial aquatic community. Most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland (see Terrestrial Biology Mapbook, a support document to the EIR/EIS, for a detailed view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. A small area (less than 1 acre) of this community would also be lost to intermediate forebay construction approximately 1.2 miles south of Hood Franklin Road and immediately west of Stone Lakes NWR. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, including in the Sacramento River at Intakes 1–5, and at temporary barge unloading facilities established at five locations along the tunnel route. The barge unloading construction would temporarily affect the Sacramento River just downstream of Walnut Grove, the North Mokelumne River adjacent to the east side of Tyler Island, the San Joaquin River in the Venice Reach just south of Venice Island, Middle River on the east side of Bacon Island just downstream of Empire Reach, and the North Victoria Canal between Woodward and Victoria Islands. The details of these locations can be seen in the Terrestrial Biology Mapbook. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 8 acres could be permanently lost and another 11 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would affect 18 acres of tidal perennial aquatic community. CM4 involves conversion of existing natural communities to a variety of tidal wetlands, including tidal perennial aquatic, tidal brackish emergent, and tidal freshwater emergent wetlands. Specific locations for these conversions are not known. The 18 acres could remain tidal perennial aquatic with a modified tidal prism, or they could eventually be converted to one of the other tidal wetland types. For purposes of this analysis, a conservative approach has been taken and the effect has been discussed simultaneously with the habitat losses associated with other conservation measures. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic habitat would be restored, based on modeling conducted by ESA PWA (refer to Table 5 in BDCP Appendix 3.B). This restoration would be consistent with BDCP Objective TPANC1.1. Approximately 3,400 acres of the restoration would happen during the first 10 years of Alternative 1A implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal natural communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 2 acres and temporarily remove 5 acres of tidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the tidal perennial aquatic habitats directly affected. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on tidal perennial aquatic habitat. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the tidal perennial aquatic community through CM1 construction losses (48 acres permanent and 133 acres temporary) and the CM2 construction losses (8 acres permanent and 11 acres temporary). The habitat would be lost primarily along the Sacramento River at intake sites or in the northern Yolo Bypass. Approximately 11 acres of the inundation and construction-related effects from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 1A implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 211 acres of restoration would be needed to offset (i.e., mitigate) the 211 acres of effect (the total permanent and temporary near-term effects listed in Table 12-1A-1) associated with near-term activities including water conveyance facilities construction.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are included in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in relatively minor (less than 1%) conversions or losses to tidal perennial aquatic community in the study area. These losses or conversions (76 acres of permanent and 149 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation conversions would occur through the course of the BDCP restoration program at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of more than 27,000 acres of high-value tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 1A implementation would offset near-term losses associated with construction activities for CM1, CM2, CM4 and CM6, avoiding any adverse effect. Alternative 1A, which includes restoration of an estimated 27,000 acres of this natural community over the course of the Plan, would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1A would result in the loss or conversion of approximately 211 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would be primarily along the Sacramento River at intake sites and within the northern section of the Yolo Bypass, while inundation conversions would be at various tidal restoration sites throughout the study area. The losses and conversions would be spread across the 10-year near-term timeframe. These losses and conversions would be offset by planned restoration of an estimated 3,400 acres of high-value tidal perennial aquatic natural community scheduled for the first 10 years of Alternative 1A implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 211 acres of restoration would be needed to offset (i.e., mitigate) the 211 acres of loss or conversion. The restoration would be initiated at the beginning of Plan implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 225 acres of the natural community would be lost or converted and an estimated 27,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1A would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Two Alternative 1A conservation measures would modify the water depths and inundation regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency, magnitude and duration of inundation-related changes in water depth and velocity of 9–36 acres of tidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 9-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 36-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of the tidal perennial aquatic community occurs in the southern section of the bypass on Liberty Island, and, to a lesser extent, along the eastern edge of the bypass, including the Tule Canal/Toe Drain. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would be expected to be beneficial to the ecological function of tidal perennial aquatic habitat in the bypass as it relates to BDCP covered aquatic species. The Yolo Bypass waterway is the key element in the Yolo Bypass landscape linkage mapped in Figure 12-2 and described in detail in BDCP Chapter 3, Table 3.2-3. The change in periodic inundation in the bypass would not substantially modify its value for special-status or common terrestrial species. Water depths and water flow rates would increase over Existing Conditions and the No Action condition in approximately 30% of the years, but it would not fragment the habitat or make it less accessible to special-status or common terrestrial species. The modifications would not result in a loss of this community. The plant species associated with this community are adapted to inundation. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of these changes in the inundation regime on terrestrial species that rely on tidal perennial aquatic habitats are discussed in detail later in this chapter, under the individual species assessments.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of flooding of 39 acres of tidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The more frequent exposure of these wetlands to stream flooding events would be beneficial to the ecological function of tidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The plant species associated with these tidal perennial aquatic areas are adapted to inundation and would not be substantially modified.

In summary, 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from flood flows as a result of implementing two Alternative 1A conservation measures (CM2 and CM5). Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area; therefore, periodic changes in water depth and velocity would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of tidal perennial aquatic natural community would not have an adverse effect on the community.

CEQA Conclusion: An estimated 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity as a result of implementing CM2 and CM5 under Alternative 1A. Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to aquatic and terrestrial species in the study area. The periodic changes in water depth and velocity would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-2 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

  The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 1A operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP action have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control* and is consistent with BDCP Objective TPANC2.1. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging.* Long-term operation of the Alternative 1A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic flooding of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects**:** Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion**:** The operation and maintenance activities associated with Alternative 1A would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration*) and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage or value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal perennial aquatic natural community.

Tidal Brackish Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no adverse effect on the habitats associated with the tidal brackish emergent wetland natural community. Habitat restoration and construction associated with CM1, CM2, CM5 and CM6 would not remove tidal brackish emergent wetland; levee breaching and minor construction associated with CM4 may temporarily remove small amounts of this natural community (see Table 12-1A-2). Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit the tidal brackish emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4)
- Within the restored and protected tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4)
- Within the restored and protected tidal natural communities and transitional uplands, restore or create at least 6,000 acres of tidal brackish emergent wetland in Conservation Zone 11 (Objective TBEWNC1.1 associated with CM4)
- Restore connectivity to isolated patches of tidal brackish emergent marsh where isolation has reduced effective use of these marshes by the species that depend on them (Objective TBEWNC1.3 associated with CM4)
- Create topographic heterogeneity in restored tidal brackish emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TBEWNC1.4 associated with CM4)
- Limit perennial pepperweed to no more than 10% cover in tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1 associated with CM11)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal brackish emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-2. Changes in Tidal Brackish Emergent Wetland Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	Unk.	Unk.	Unk.	Unk.	0	0
CM5	0	0	0	0	0	0
CM6	0	0	0	0	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and operation of the Alternative 1A water conveyance facilities (CM1) would not affect tidal brackish emergent wetland natural community. Restoration of tidal marsh habitats associated with CM4 would require site preparation, earthwork, and other site activities that could remove tidal brackish emergent wetland. Levee modifications, grading or contouring, filling to compensate for land subsidence, and creation of new channels could also result in the removal of tidal brackish emergent wetland. All of this construction and land modification activity that could affect tidal brackish emergent wetland would occur in Suisun Marsh (CZ 11). The acreage of loss has not been calculated because the specific locations for site preparation and earthwork have not been identified, but the loss would likely be very small (less than 1 acre). These activities would occur in small increments through the course of the BDCP restoration program. The protection and restoration elements of CM4 would greatly exceed any of the short-term losses described above. At least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area (BDCP Objective TBEWNC1.1 associated with CM4), with 2,000 acres of restoration occurring in the near-term timeframe (Table 12-1A-2). In addition, the habitat and ecosystem functions of BDCP restored tidal brackish emergent wetland would be maintained and enhanced (CM11). The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.3.2) states that at least 6,000 acres of tidal brackish emergent wetland community would be restored in CZ 11, and that tidal natural communities restoration would decrease habitat fragmentation by providing additional connectivity between isolated patches of tidal brackish emergent wetland. This restoration would also occur under Alternative 1A.

The restoration activities associated with CM4 in Suisun Marsh would result in other effects that could alter the habitat value of tidal brackish emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Tidal flooding of dry areas could also increase the bioavailability of methylmercury in Suisun Marsh. Site-specific conditions would dictate the significance of this hazard to tidal brackish marsh vegetation and associated wildlife. According to the Suisun Marsh Plan EIR/EIS (Bureau of Reclamation et al. 2010, pg. 5.2-18), marsh creation may generate less methylmercury than is currently being generated by managed wetlands. However, this has not been confirmed through comprehensive studies. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh and the potential for increased nitrogen deposition associated with construction vehicles are also issues of concern that are difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal brackish emergent wetland in the study area.

NEPA Effects: The increase of tidal brackish emergent wetland associated with CM4 would be a beneficial effect on the natural community.

CEQA Conclusion: Tidal brackish emergent wetland natural community could experience small losses in acreage in Suisun Marsh (CZ 11) as a result of the large-scale tidal marsh restoration planned as part of CM4. These losses (not expected to exceed 1 acre) would be associated with levee modification, site preparation and other earthwork needed to expose diked lands to tidal influence. Because at least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area as part of CM4, including 2,000 acres restored in the near-term timeframe, there would be a large increase in tidal brackish emergent wetland both in the near-term and over the life of the Plan. Indirect effects associated with the expansion of tidal brackish emergent wetland natural community, including the potential spread of invasive species, the generation of methylmercury, increases in marsh water temperatures, and increased nitrogen deposition are not expected to have a significant impact on this natural community in the study area. Therefore, this impact would be beneficial.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with CM1 and CM4 of Alternative 1A are constructed and the water management practices associated with changed reservoir operations, diversions from the north Delta, and marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions would involve water releases and diversions, access road and levee repair, replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta

channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh channels would be expected to increase with reduced Sacramento River outflows (see Chapter 8, Section 8.3.3.9), but this change would not be sufficient to change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which has a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3 for a detailed analysis of this issue). Alternative 1A, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road and levee repair*. Periodic repair of access roads and levees associated with the BDCP actions has the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of AMM2 Construction Best Management Practices and Monitoring and AMM4 Erosion and Sediment Control Plan. Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment (CM11) would be a periodic activity associated with the long-term maintenance of restoration sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.
- *Channel dredging.* Long-term maintenance of tidal channels that support wetland expansion in Suisun Marsh would include periodic dredging of sediments. The dredging would take place adjacent to tidal brackish emergent wetland natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value in the short term for special-status and common species that rely on it for cover, movement corridor or foraging area. The individual species effects are discussed later in this chapter.
- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, channel dredging and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area.

NEPA Effects: There would be no adverse effect on the tidal brackish emergent wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes (not exceeding 1 acre) in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11* Natural *Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand tidal brackish emergent wetland natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of small acreages of this community (see Table 12-1A-3). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the tidal freshwater emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4)
- Within the 65,000 acres of tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4)
- Within the 65,000 acres of tidal natural communities, restore or create at least 24,000 acres of tidal freshwater emergent wetland in Conservation Zones 1, 2, 4, 5, 6 and/or 7 (Objective TFEWNC1.1, associated with CM4)
- Restore tidal freshwater emergent wetlands in areas that increase connectivity among conservation lands (Objective TFEWNC1.2, associated with CM4)
- Restore and sustain a diversity of marsh vegetation that reflects historical species compositions and high structural complexity (Objective TFEWNC2.1, associated with CM4)

- Create topographic heterogeneity in restored tidal freshwater emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TFEWNC2.2, associated with CM4)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal freshwater emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-3. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	6	6	6	6	0	0
CM2	6	6	0	0	24–58	0
CM4	1	1	0	0	0	0
CM5	0	1	0	1	0	3
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**13**	**14**	**6**	**7**	**24–58**	**3**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 14 acres and temporarily remove 7 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add at least 24,000 acres of tidal freshwater emergent wetland natural community during the course of Plan restoration activities, which would expand the area of that habitat and offset the losses. The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.4.2) states that the implementation of *CM4 Tidal Natural Communities Restoration* would restore at least 24,000 acres of tidal freshwater emergent wetland community in Cache Slough (Conservation Zones 1, 2, and 3), the Cosumnes/Mokelumne (Conservation Zone 4), West Delta (Conservation Zone 5 and 6), and South Delta (Conservation Zone 7) ROAs. The BDCP evaluation also states that the objectives in the Plan would promote vegetation diversity and structural complexity (as incorporated into the restoration design) in restored tidal freshwater marsh. The same restoration actions would be undertaken as part of Alternative 1A.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 6 acres and temporarily remove 6 acres of tidal freshwater emergent wetland community. Most of the loss associated with intake construction would be in the vicinity of Hood, just south of the Hood Franklin Road, and along rivers and canals in the central Delta as a result of barge unloading facility construction (Middle River on the east side of Bacon Island and the North Victoria Canal at the north end of Victoria Island; see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

  There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of CM1. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction or channel modification activities within the Yolo and Sacramento Bypasses, including improvements in flow through the west side channel of the bypass, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in tidal freshwater emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 6 acres could be permanently lost to these activities. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on hypothetical footprints of this restoration activity, initial land grading and levee modification could permanently remove up 1 acre of tidal freshwater emergent wetland natural community. This loss would occur during the near-term timeframe throughout the ROAs identified for tidal wetland restoration. At the same time, an estimated 24,000 acres of tidal freshwater emergent wetland community would be restored during tidal habitat restoration, consistent with Objective TFEWNC1.1 (associated with CM4). Approximately 8,850 acres of the restoration would happen during the first 10 years of Alternative 1A implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal wetland communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Restoration would be located and designed to improve habitat connectivity (Objective TFEWNC1.2), improve marsh species diversity (Objective TFEWNC2.1), and provide variation in inundation characteristics (Objective TFEWNC2.2). Some of the restoration would happen in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

The restoration activities associated with CM4 in the Plan Area ROAs would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal freshwater marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough, Cosumnes/Mokelumne and Suisun Marsh ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater emergent wetland habitat. The construction-related losses would be considered a permanent removal of the habitats directly affected. The majority of seasonally inundated floodplain restoration is expected to be implemented along the lower San Joaquin River in the south and central Delta areas. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on freshwater marsh and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would take place on narrow strips of habitat, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that would offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the tidal freshwater emergent wetland natural community through CM1 construction losses (6 acres permanent and 6 acres temporary), CM2 construction losses (6 acres permanent), and CM4 construction losses (1 acre permanent). The tidal freshwater emergent wetland natural community would be lost in the north Delta near Hood, in the central Delta on the fringes of Bacon and Victoria Islands, and at various locations within the Yolo Bypass and the tidal restoration ROAs.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 1A implementation would more than offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 19 acres of restoration would be needed to offset (i.e., mitigate) the 19 acres of loss (the total permanent and temporary near-term effects listed in Table 12-1A-3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are included in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in relatively minor (less than 1%) losses of tidal freshwater emergent wetland community in the study area. These losses (16 acres of permanent and 7 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and levee modification and land grading for tidal marsh restoration (CM4) and floodplain restoration (CM5). The CM4 and CM5 losses would occur during the course of conservation actions at various tidal and floodplain restoration sites throughout the study area. By the end of the Plan timeframe, a total of 24,000 acres of this natural community would be restored over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of BDCP implementation would more than offset the construction and inundation-related effects of implementing CM1, CM2, CM4 and CM5, avoiding any adverse effect in the near-term. Because of the 24,000 acres of tidal freshwater emergent wetland restoration that would occur over the course of the Plan, Alternative 1A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1A would result in the loss of approximately 19 acres of tidal freshwater emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and tidal marsh restoration (CM4). The construction losses would occur in both the north Delta near Hood and in the central Delta on the fringes of Bacon and Woodward Islands. The losses would be spread across a 10-year near-term timeframe and would be offset by planned restoration of 8,850 acres of tidal freshwater emergent wetland natural community scheduled for the first 10 years of Alternative 1A implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 19 acres of restoration would be needed to offset (i.e., mitigate) the 19 acres of loss. The restoration would be initiated at the beginning of Plan implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 21 acres of tidal freshwater emergent wetland natural community would be lost to conservation activities, and 24,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1A would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal freshwater emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency, magnitude and duration of inundation of 24–58 acres of tidal freshwater emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently inundated would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 24-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 58-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of this community occurs in the southern section of the bypass on Liberty Island, on the fringes of tidal perennial aquatic habitats. Smaller areas are scattered among the cropland within the bypass, south of Interstate 80. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of tidal freshwater emergent wetland habitats and would not substantially modify its value for special-status or common terrestrial species. The plants in this natural community are adapted to periodic inundation events within the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of inundation of 3 acres of tidal freshwater emergent wetland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused along the major rivers and Delta channels in the south Delta. The reconnection of these wetlands to stream flooding events would be beneficial to

the wetlands' ecological function, especially as they relate to the BDCP's target terrestrial and aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 27-61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing two Alternative 1A conservation measures (CM2 and CM5). Tidal freshwater emergent wetland natural community is a habitat of great value to both terrestrial and aquatic species in the study area.

NEPA Effects: Periodic inundation would not result in a net permanent reduction in the acreage or value of tidal freshwater emergent wetland natural community in the study area. Therefore, there would be no adverse effect.

CEQA Conclusion: An estimated 27-61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. This community is of great value to aquatic and terrestrial species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage or value of this community in the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-7 for effects associated with CM2). The periodic actions would involve access road and conveyance facilities repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations (Operational Scenario A), and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1A would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a significant reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which has a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3 for a detailed analysis of this issue). Alternative 1A, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (CM11). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would be done in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A, including changed water operations in the upstream rivers, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1A-4). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the valley/foothill riparian natural community.

- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7 by year 10 (ObjectiveVFRNC1.2, associated with CM3)
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5 and CM7)
- Maintain 500 acres of mature riparian forest in Conservation Zones 4 or 7 (Objective VFRNC2.3, associated with CM3 and CM7)
- Maintain 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to late-successional riparian vegetation (VFRNC2.2,) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7)
- Maintain or increase abundance and distribution of valley/foothill riparian natural community vegetation alliances that are rare or uncommon as recognized by California Department of Fish and Game (2010), such as button willow thickets alliance and blue elderberry stands alliance (Objective VFRNC3.1)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of valley/foothill riparian natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-4. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	58	58	28	28	0	0
CM2	89	89	88	88	51–92	0
CM4	298	552	0	0	0	0
CM5	0	43	0	35	0	266
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**445**	**742**	**116**	**151**	**51–92**	**266**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 742 acres and temporarily remove 151 acres of valley/foothill riparian natural community in the study area. These modifications represent less than 5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Valley/foothill riparian protection (750 acres) and restoration (800 acres) would be initiated during the same period, which would begin to offset the losses, thereby making them not adverse under NEPA and less than significant under CEQA. By the end of the Plan period, 5,000 acres of this natural community would be restored. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.5.2) indicates that implementation of Alternative 4 would restore or create 5,000 acres of riparian forest and scrub in Conservation Zones 1, 2, 4, 5, 6, and 7, with at least 3,000 acres occurring on restored seasonally inundated floodplain. Alternative 4 would also protect 750 acres of existing valley/foothill riparian natural community in

Conservation Zone 7. These same conservation actions would occur with implementation of Alternative 1A.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 58 acres and temporarily remove 28 acres of valley/foothill riparian natural community. Most of the permanent loss would be where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation (see Terrestrial Biology Mapbook). Smaller areas dominated by blackberry would be eliminated at the forebay site adjacent to Clifton Court Forebay. There would be temporary losses where pipelines cross Snodgrass Slough and other small waterways east of the Sacramento River, and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers of valley oak and scrub bordering waterways. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 89 acres could be permanently lost and another 88 acres could be temporarily removed. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. This vegetation is a mix of valley oak, cottonwood, sycamore and willow trees. The riparian areas here are primarily small, disconnected patches with moderate to low value as wildlife movement corridors. Most of these patches lack structural complexity. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would remove similar linear strips of vegetation. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 552 acres of valley/foothill riparian community. The losses would be spread among most of the ROAs established for tidal restoration (see Figure 12-1). No losses would occur from Suisun Marsh restoration. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (BDCP Chapter 5, Section 5.4.5.1.1). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted by use of the theoretical footprint. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 43 acres and temporarily remove 35 acres of valley/foothill riparian natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San

Joaquin River and other major waterways in CZ 7 (see Figure 12-1). This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration*: The valley/foothill riparian natural community would be restored primarily in association with the tidal (CM4) and floodplain (CM5) restoration and channel margin enhancements. Following community-specific goals and objectives in the Plan, a total of 5,000 acres of this community would be restored (Objective VFRNC1.1) and 750 acres would be protected (Objective VFRNC1.2) over the life of the Plan. Approximately 800 acres would be restored and the entire 750 acres would be protected during the first 10 years of Alternative 1A implementation. Riparian restoration and protection would be focused in CZs 4 and 7 (Objective VFRNC2.3), with a goal of adding a 500-acre portion of the restoration in one or the other of these zones. A variety of successional stages would also be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area (Objective VFRNC2.4).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the valley/foothill riparian natural community through CM1 construction losses (58 acres permanent and 28 acres temporary) and the CM2 construction losses (89 acres permanent and 88 acres temporary). The natural community would be lost primarily along the eastern bank of the Sacramento River at intake sites, along pipeline routes connecting these intakes to the forebay, and in the northern Yolo Bypass. Approximately 298 acres of the inundation and construction-related loss from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with BDCP conservation components. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined by Section 404 of the CWA. As indicated above, most of the losses would be in small patches or narrow strips along waterways with limited structural complexity. However, the restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 1A implementation would minimize this near-term loss, avoiding an adverse effect. At least 400 acres of the protection is planned for the first 5 years of Alternative 1A implementation. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 561 acres of protection and 561 acres of restoration would be needed to offset (i.e., mitigate) the 561 acres of loss (the combination of permanent and temporary losses in the near-term listed in Table 12-1A-4). The combination of the two approaches (protection and restoration) are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM18 Swainson's Hawk.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in approximately 5% losses of valley/foothill riparian community in the study area. These losses (742 acres of permanent and 151 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and setback of levees during floodplain expansion (CM5). Inundation losses would occur during the course of Plan restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 5,000 acres of this natural community would be restored and 750 acres would be protected (CM7 and CM3, respectively). The restoration would occur primarily in CZs 4 and 7, in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

NEPA Effects**:** The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of BDCP implementation would minimize the near-term loss of this community, avoiding any adverse effect. Because of the Plan's commitment to restoration of 5,000 acres and protection of 750 acres of valley/foothill riparian natural community during the course of the Plan, Alternative 1A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1A would result in the loss of approximately 561 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The natural community would be lost primarily along the Sacramento River at intake sites, along pipeline routes connecting these intakes to the forebay, and within the northern section of the Yolo Bypass, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe. These losses would be minimized by planned restoration of 800 acres (CM7) and protection (including significant enhancement) of 750 acres (CM3) of valley/foothill riparian natural community scheduled for the first 10 years of Alternative 1A implementation. At least 400 acres of the protection is planned for the first 5 years of Alternative 1A implementation. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts. Because of these near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 561 acres of protection and 561 acres of restoration would be needed to offset (i.e., mitigate) the 561 acres of loss. The combination of the two approaches (protection and restoration) are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of Alternative 1A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 893 acres of valley/foothill riparian natural community would be permanently or temporarily removed by conservation actions, 5,000 acres would be restored and 750 acres would be protected. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1A would not have a substantial adverse effect on this natural community; the impact on the valley/foothill riparian natural community would be beneficial.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of valley/foothill riparian natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency, magnitude and duration of inundation of 51–92 acres of valley/foothill riparian natural community. The area more frequently inundated would vary with the flows passed through the newly constructed notch in the Fremont Weir. The 51 acres would be created by a notch flow of 8,000 cfs and the 92 acres would be created by a notch flow of 4,000 cfs. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. These increased flow conditions would be expected to occur in no more than 30% of all years (see BDCP Chapter 5, Section 5.4.1.2). The valley/foothill riparian community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass. There are other riparian habitat areas on Liberty Island, and, to a lesser extent, along the eastern and western edges of the bypass, including along the Tule Canal/Toe Drain, the west side channels and the Sacramento Bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect riparian habitats, as they have persisted under similar high flows and extended inundation periods in the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 266 acres of valley/foothill riparian habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The reconnection of riparian vegetation to periodic stream flooding events would be beneficial to the ecological function of this natural community, especially in the germination and establishment of native riparian plants as flood scour increases.

In summary, from 317 to 368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundations a result of implementing two Alternative 1A conservation measures (CM2 and CM5). The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. The increased inundation could create a beneficial effect on the community as it relates to germination and establishment of native riparian plants.

NEPA Effects: Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial effect on the community.

CEQA Conclusion: An estimated 316 to 367 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial impact on the community.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see Impact BIO-10 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with Alternative 1A, as compared with No Action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with

Operational Scenario A) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced by as much as 19% in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 48% with implementation of Alternative 1A (Operational Scenario A). Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 11–27% compared with No Action, during certain months and water-year type (see Section 11C.1 in Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1A would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may change the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural

community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat. The BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM18 and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with implementation of Alternative 1A would not result in a net permanent reduction in valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion**:** The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM18, and AMM37 would minimize these impacts; and other operations and maintenance activities, including management, protection and enhancement actions associated with CM3 *Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration and protection activities associated with *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1A-5). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the nontidal perennial aquatic natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-5. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	12	12	9	9	0	0
CM2	24	24	12	12	50–77	0
CM4	34	189	0	0	0	0
CM5	0	28	0	16	0	25
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**70**	**253**	**21**	**37**	**50–77**	**25**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 298 acres and temporarily remove 35 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 6% of the 5,567 acres of the community that is mapped in the study area. Approximately 40% (134 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 400 acres (CM10) of nontidal marsh during the same period, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh, and that the restoration would occur in blocks that would be contiguous with the Plan's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998).

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 57 acres and temporarily remove 7 acres of nontidal perennial aquatic community. Most of the permanent loss would occur along the north-south transmission corridor in the central and southern Delta (see Terrestrial Biology Mapbook). Most of the temporary loss would occur where temporary access roads would be constructed on Mandeville and Bouldin Islands. These wetlands are small ponds, stringers and ditches adjacent to farming roads. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels modifications, Putah Creek realignment activities, and Sacramento Weir and Tule Canal improvements. All of these activities could involve excavation and grading in nontidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently lost and another 12 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently change to tidally influenced inundation or remove 189 acres of nontidal perennial aquatic community. These losses would be expected to occur primarily in the Cache Slough and Cosumnes/Mokelumne ROAs (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored. Approximately 400 acres of the restoration (CM10) would happen during the first 10 years of Alternative 1A implementation, which would coincide with the timeframe of water conveyance facilities construction and early restoration activities. The remaining restoration would be spread over the following 30 years. Nontidal natural communities restoration is expected to be focused in CZs 2, 4 and/or 5 identified in Figure 12-1.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would permanently remove 28 acres and temporarily remove 16 acres of nontidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the nontidal perennial aquatic habitats. It is expected that floodplain restoration would be focused on the south part of the Plan Area, in CZ 7. Floodplain restoration along the southern Delta rivers would improve connectivity for a variety of species that rely on aquatic and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River, Middle River and Old River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would be on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. Channel margin would be enhanced within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the nontidal perennial aquatic community through CM1 construction losses (57 acres permanent and 7 acres temporary) and the CM2 construction losses (24 acres permanent and 12 acres temporary). The natural community would be lost primarily at scattered locations along the north-south transmission corridor and along access roads adjacent to the tunnel route in the central Delta, and along the west side channels and channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. Approximately 34 acres of the inundation and construction-related losses from CM4 would occur during the near-term throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, creating 400 acres of nontidal marsh as part of CM10 during the first 10 years of Alternative 1A implementation would more than offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 134 acres of restoration and 134 acres of protection would be needed to offset (i.e., mitigate) the 134 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in relatively minor (6%) losses of nontidal perennial aquatic community in the study area. These losses (298 acres of permanent and 35 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), change to tidally influenced inundation during tidal marsh restoration (CM4), and floodplain restoration (CM5). The change to tidally influenced inundation would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored over a wide region of the study area, including within the Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: During the first 10 years of implementing Alternative 1A, creating 400 acres of nontidal marsh as part of CM10 would offset the construction-related and inundation losses of 134 acres of nontidal perennial aquatic natural community. There would be no adverse effect. During the full duration of Plan implementation, Alternative 1A would not result in a net reduction in the acreage of a sensitive natural community; there would be an expansion of nontidal marsh and the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1A would result in the loss of approximately 134 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The natural community would be lost at scattered locations in the vicinity of the Sacramento River intakes and pipelines, and along access roads adjacent to the tunnel route in the central Delta. The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres of nontidal perennial aquatic natural community scheduled for the first 10 years of Alternative 1A implementation (CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 134 acres of restoration and 134 acres of protection would be needed to offset (i.e., mitigate) the 134 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection. The restoration would be initiated at the beginning of Alternative 1A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 333 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. The nontidal marsh would consist of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1A would not have a substantial adverse effect on this natural community; the impact on the nontidal perennial aquatic natural community would be beneficial.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency, magnitude and duration of inundation of 50-77 acres of nontidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 50-acre increase in inundation would be associated with a notch flow of 3,000 cubic feet per second (cfs), and the 77-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and patches throughout the bypass, including along the Tule Canal/Toe Drain, the western channels north of Interstate 80, and below the Fremont and Sacramento Weirs. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 25 acres of nontidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The periodic flooding may also encourage germination of nontidal marsh vegetation.

In summary, 75-102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1A conservation measures (CM2 and CM5). Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal perennial aquatic natural community in the Yolo Bypass and along south Delta waterways would not reduce the acreage of this natural community and could encourage germination of aquatic vegetation. This increased inundation would not be adverse.

CEQA Conclusion: An estimated 75-102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. Nontidal perennial aquatic community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with CM1 (see Impact BIO-13 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 1A operations scheme would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*), would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this community.

CEQA Conclusion**:** The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of the BDCP would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1A-6). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the nontidal freshwater perennial emergent wetland natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)
- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal freshwater perennial emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-6. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	1	1	1	1	0	0
CM2	25	25	1	1	6–8	0
CM4	40	99	0	0	0	0
CM5	0	0	0	0	0	8
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**66**	**125**	**2**	**2**	**6–8**	**8**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 126 acres and temporarily remove 6 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 9% of the 1,509 acres of the community that is mapped in the study area. Approximately 55% (73 acres) of the permanent and temporary losses would happen during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 400 acres (CM10) and natural communities protection would protect 50 acres (CM3) of nontidal marsh during the same period, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in BDCP Objective NFEW/NPANC1.1 (BDCP Chapter 3, Table 3.3-2). The nontidal marsh protection would be designed to support tricolored blackbird populations in the study area. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh. The restoration would occur in blocks that would be contiguous with the alternative's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation efforts would be a part of implementing Alternative 1A.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater perennial emergent wetland community. The permanent loss would occur at the southern forebay construction site (see Terrestrial Biology Mapbook). The temporary loss would occur where a temporary access road would be constructed on Bouldin Island. These wetlands are extremely small and remote water bodies. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels and Tule Canal modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in nontidal freshwater perennial emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 25 acres could be permanently lost and 1 acre could be temporarily removed. These losses would most likely occur in the Tule Canal and west side channels at the north end of the bypass. The habitat here includes narrow bands within these side channels of the bypass and is isolated from other marsh or open water habitats. The narrow bands are bordered by riparian habitats, primarily willows and cottonwoods. This activity would occur in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 99 acres of nontidal freshwater perennial emergent wetland community. These losses would be expected to occur primarily in the Cache Slough ROA (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored (CM10) and 50 acres would be protected (CM3) during nontidal habitat conservation actions. Approximately 400 acres of the restoration and 25 acres of the protection would happen during the first 10 years of Alternative 1A implementation, which would coincide with the timeframe of water conveyance facilities construction and early tidal marsh restoration. The remaining restoration would be spread over the following 30 years. Nontidal marsh natural communities restoration is expected to be focused in the vicinity of giant garter snake populations in the eastern Delta and near the Yolo Bypass. *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would not affect nontidal freshwater perennial emergent wetland natural community.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the nontidal freshwater perennial emergent wetland community through CM1 construction losses (1 acre permanent and 1 acre temporary) and the CM2 construction losses (25 acres permanent and 1 acre temporary). These losses would occur at the southern forebay, along temporary access roads in the central Delta, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 during the first 10 years of Alternative 1A implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 68 acres of restoration and 68 acres of protection would be needed to offset (i.e., mitigate) the 68 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM*6 *Disposal and Reuse of Spoils, AMM*7 *Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in small (8%) losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (125 acres of permanent and 2 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the CM4 restoration activities primarily at Cache Slough ROA. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored and 50 acres would be protected. The restoration would occur near giant garter snake occupied habitat in the eastern Delta and near Yolo Bypass, in CZs 2, 4 and 5, and the protection would occur in CZ 1, 2, 8 or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: In the near-term, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 would offset the near-term losses associated with construction of CM1, CM2 and CM4 facilities, avoiding any adverse effect. With 1,200 acres of nontidal marsh restoration (BDCP Objective NFEW/NPANC1.1) and 50 acres of protection (BDCP Objective TRBL1.1) included with full implementation of the Plan, Alternative 1A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1A would result in the loss of approximately 28 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2). The construction losses would occur at the southern forebay, along temporary access roads in the central Delta, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA mapped in Figure 12-1. The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres and protection of 25 acres of nontidal marsh scheduled for the first 10 years of Alternative 1A implementation (CM3 and CM10). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 68 acres of restoration and 68 acres of protection would be needed to offset (i.e., mitigate) the 68 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection. The restoration and protection would be initiated at the beginning of Alternative 1A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 127 acres of the natural community would be removed, 1,200 acres of nontidal marsh would be restored (BDCP Objective NFEW/NPANC1.1), and 50 acres of nontidal marsh would be protected (BDCP Objective TRBL1.1). There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1A would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal freshwater perennial emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency and duration of inundation of 6-8 acres of nontidal freshwater perennial emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 6-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 8-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and isolated patches along the Tule Canal and western channel in the north end of the bypass. These areas are not connected to other adjacent marsh and open water habitats; they are surrounded by riparian habitat, scoured grassland and agricultural lands. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal freshwater perennial emergent wetland plant species in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this increased inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 8 acres of nontidal freshwater perennial emergent wetland habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal freshwater perennial emergent wetland habitats, as they relate to BDCP target aquatic species. The added exposure to inundation could also encourage germination of nontidal marsh plant species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 14 to 16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1A conservation measures (CM2 and CM5). This community would not be adversely affected because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal freshwater perennial emergent wetland natural community in the Yolo Bypass and in the southern Delta would not reduce the acreage of this natural community and could encourage germination of emergent wetland vegetation. The increased inundation would not be an adverse effect.

CEQA Conclusion: An estimated 14-16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. This community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-16 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM*4 *Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal freshwater perennial emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of CM2 and CM4 would result in permanent removal of this community (see Table 12-1A-7). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the alkali seasonal wetland natural community.

- Protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8 and/or 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3)
- Restore or create alkali seasonal wetlands in Conservation Zones 1, 8, and/or 11 to achieve no net loss of wetted acres (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9)
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of alkali seasonal wetland natural community for terrestrial species. As explained below, with the protection, restoration, and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-7. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	45	45	0	0	264–744	0
CM4	13	27	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**58**	**72**	**0**	**0**	**264–744**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM2 and CM4 would permanently eliminate an estimated 72 acres of alkali seasonal wetland complex natural community in the study area. These modifications represent approximately 2% of the 3,723 acres of the community that is mapped in the study area. Most of the losses (58 acres or 80%) would occur during the first 10 years of Alternative 1A implementation, as Yolo Bypass improvements and habitat restoration is initiated. Alkali seasonal wetland complex protection (120 acres) and restoration (an estimated 58 acres, but determined by actual level of effect) would be initiated during the same period, which would offset the. By the end of the Plan period, 150 acres of this natural community would be protected and 72 acres would be restored. The BDCP beneficial effects analysis for this community (BDCP Chapter 5, Section 5.4.7.2) states that Alternative 4 would protect at least 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, or 11, in a mosaic of protected grasslands and vernal pool complex. This would protect currently unprotected high-value alkali seasonal wetland complex in the Plan Area. The Alternative 1A conservation measures would provide the same level of restoration and protection as Alternative 4.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would not affect alkali seasonal wetland complex natural community.

  While there would be no direct effects from construction activity associated with CM1, there is the potential that construction would lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Realignment of Putah Creek could involve excavation and grading in alkali seasonal wetland complex as a new channel is constructed. Based on hypothetical construction footprints, a total of 45 acres could be permanently lost. This complex is located immediately south of the existing Putah Creek channel within the bypass, and is a relatively large, moderate to high value, contiguous expanse of this community. This loss would occur in the near-term timeframe.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 150 acres of alkali seasonal wetland complex in CZs 1, 8, and 11 (Objective ASWNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13 acres of alkali seasonal wetland complex in the near-term and inundate or remove 27 acres by the end of the Plan timeframe. The losses would be expected to occur in the Cache Slough and Suisun Marsh ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the Lindsay Slough area and on the northern fringes of Suisun Marsh, north of the Potrero Hills. These losses would not fragment the alkali seasonal wetland communities adjacent to these sloughs because the losses would occur on the edges of the existing habitat.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: BDCP CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the conservation measure is to match the acreage of restoration with the actual acreage lost to other conservation measures (primarily CM2 and CM4). The current estimate for alkali seasonal wetland complex restoration is 58 acres in the near-term and a total of 72 acres by the end of the BDCP's restoration period. The goal is for no net loss of this natural community, consistent with BDCP Objective ASWNC1.2. Restoration in the Lindsay Slough area of the Cache Slough ROA and the northern region of the Suisun Marsh ROA would be consistent with essential habitat connectivity goals mapped in Figure 12-2 and described in Table 3.2-3 of BDCP Chapter 3.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the alkali seasonal wetland complex natural community through CM2 construction losses (45 acres). These losses would occur in the Yolo Bypass south of Putah Creek. Approximately 13 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough and Suisun Marsh ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of up to 58 acres of this community as part of CM9 during the first 10 years of Alternative 1A implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres of restoration would be needed to offset (i.e., mitigate) the 58 acres of loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in relatively minor (2%) losses of alkali seasonal wetland natural community in the study area. These losses (72 acres) would be largely associated with construction of Yolo Bypass fish improvements (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities, primarily in the Cache Slough and Suisun Marsh ROAs.

***NEPA Effects*:** In the first 10 years of implementing Alternative 1A conservation measures, 120 acres of alkali seasonal wetland complex would be protected as part of CM3 and up to 58 acres of this community would be restored as part of CM9. These conservation actions would offset the near-term loss of this community associated with CM2 and CM4, avoiding any adverse effect. By the end of the Plan timeframe, Alternative 1A would protect a total of 150 acres of alkali seasonal wetland natural community (CM3) and would restore up to 72 acres (CM9). The protection and restoration would occur primarily in CZ 1, CZ 8 and/or CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Therefore, Alternative 1A would not have an adverse effect on the alkali seasonal wetland complex natural community.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1A would result in the permanent loss of approximately 58 acres of alkali seasonal wetland complex natural community due to construction of fish passage improvements (CM2) and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily in the area just south of Putah Creek in the Yolo Bypass, while inundation losses would occur in the Cache Slough and Suisun Marsh ROAs. The losses would be spread across a 10-year near-term timeframe.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of 58 acres of this community as part of CM9 during the first 10 years of Alternative 1A implementation would offset this near-term loss, avoiding any significant impact. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres or restoration would be needed to offset (i.e., mitigate) the 58 acres of loss. AMM1, AMM2, AMM3, AMM4, and AMM10 would also be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 72 acres of alkali seasonal wetland complex natural community would be permanently removed by conservation actions, 150 acres would be protected and up to 72 acres would be restored. The restoration acres actually developed would depend on the number of acres affected during Alternative 1A implementation. There would be no net permanent reduction in the acreage of this natural community within the study area. Therefore, Alternative 1A would have a less-than-significant impact on this natural community.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of alkali seasonal wetland complex natural community at scattered locations in the central and southern sections of the bypass.

Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency and duration of inundation on an estimated 264–744 acres of alkali seasonal wetland complex natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 264-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 744-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The alkali seasonal wetland complex natural community occurs primarily in the central and southern reaches of the bypass, south of Putah Creek. The stands in this location are relatively large, with moderate to high value for associated plant and wildlife species. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1A would not adversely affect alkali seasonal wetland complex habitats, as they have persisted under similar high flows and extended flow periods. There is the potential for some change in plant species composition as a result of longer inundation periods, but the natural community would persist.

CEQA Conclusion: An estimated 264–744 acres of alkali seasonal wetland complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1A. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of alkali seasonal wetland complex natural community in the Yolo Bypass would have a less-than-significant impact on this natural community. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A were constructed and the stream flow regime associated with changed water management was in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels and recreation in and adjacent to Plan reserves. These actions are associated with CM1 and CM11 (see Impact BIO-19 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *CM3 Natural Communities Protection and Restoration*, and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management* would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the Alternative 1A conservation components would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Construction of CM1 and habitat restoration associated with CM4 would result in permanent removal of 375 acres of this community (see Table 12-1A-8). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the vernal pool complex natural community.

- Protect at least 600 acres of existing vernal pool complex in Conservation Zones 1, 8, and 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3)
- Restore vernal pool complex in Conservation Zones 1, 8, and/or 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of vernal pool complex natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-8. Changes in Vernal Pool Complex Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	3	3	0	0	0	0
CM2	0	0	0	0	0–4	0
CM4	201	372	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**204**	**375**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1 and CM4 could permanently eliminate an estimated 375 acres of vernal pool complex natural community in the study area. These acreages are based on the proposed location of the CM1 construction footprint and a theoretical footprint for CM4 tidal marsh restoration activities. The loss of this 375 acres would represent approximately 3% of the 12,133 acres of the community that is mapped in the study area. An estimated 204 acres of the loss could occur during the first 10 years of Alternative 1A implementation, as the water conveyance facility is constructed and tidal marsh restoration is initiated. Vernal pool complex protection (400 acres) and restoration (an estimated 40 acres, with actual restoration based on level of effect) would be initiated during the first 10 years of Alternative 1A implementation to counteract the loss of habitat. By the end of the Plan period, 600 acres of this natural community would be protected and up to 67 acres would be restored. Because of the high sensitivity of this natural community and its shrinking presence in the Plan Area, avoidance and minimization measures have been built into the BDCP to eliminate the majority of this potential loss. The BDCP beneficial effect analysis (BDCP Chapter 5, Section 5.4.8.2) indicates that implementation of Alternative 4 would protect at least 600 acres of vernal pool complex in Conservation Zones 1, 8, and 11 and additional vernal pool complex would be restored to achieve no net loss of this community. The same conservation actions for vernal pool complex natural community would be implemented for Alternative 1A.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would directly affect 3 acres of vernal pool complex natural community. The permanent loss would occur along the southern edge of Clifton Court Forebay, where the forebay would be expanded to provide greater storage capacity (see Figure 12-1 and the Terrestrial Biology Mapbook).

  Because of the close proximity of construction activity to adjacent vernal pool complex, both near Clifton Court Forebay and Stone Lakes National Wildlife Refuge, there is also the potential for indirect loss of or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis later in this chapter.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay and Stone Lakes National Wildlife Refuge. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay and east of the construction areas adjacent to Stone Lakes NWR. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. At Stone Lakes National Wildlife Refuge, the USFWS refuge management undertakes active invasive species control, including use of grazing. No adverse effect is expected.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 600 acres of vernal pool complex in CZs 1, 8, and 11 (BDCP Objective VPNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 tidal marsh restoration in CZs 1 and 11 (Cache Slough and Suisun Marsh ROAs; see Figure 12-1) could permanently inundate or remove 201 acres of vernal pool complex in the near-term timeframe. By the end of the Plan period, a total of 372 acres could be affected. The principal areas likely to be affected include the Cache Slough drainage just west of the Yolo Bypass and the Nurse Slough drainage just east of the Potrero Hills.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool complex restoration is 40 acres in the near-term and a total of 67 acres by the end of the BDCP's restoration period. This restoration conservation measure includes the "no net loss" policy normally applied to this natural community (BDCP Objective VPNC1.2), and the intent is that vernal pool complex restoration would occur prior to or concurrent with impacts (BDCP Chapter 3, Section 3.4.4.27).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that would offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect 204 acres of vernal pool complex natural community through inundation or construction-related losses in habitat from CM1 and CM4 activities. This loss would likely occur in the Cache Slough or Suisun Marsh ROAs, and immediately adjacent to Clifton Court Forebay mapped in Figure 12-1.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (with a commitment to keep pace with actual losses) as part of CM9 during the first 10 years of Alternative 1A implementation would partially offset this near-term loss. The Plan focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 408 acres of protection and 204 acres of restoration would be needed to offset (i.e., mitigate) the 204 acres of loss. Without additional avoidance and minimization measures to reduce the potential effect, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses.

To avoid this adverse effect, the BDCP includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM30 Transmission Line Design and Alignment Guidelines.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. The 10 wetted acres is equivalent to approximately 67 acres of vernal pool complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With these AMMs in place, the BDCP would not adversely affect vernal pool complex natural community in the near-term.

Late Long-Term Timeframe

The late long-term effect on vernal pool complex natural community would be 375 acres of permanent loss. The loss would be associated with the construction of CM1 facilities in the vicinity of Clifton Court Forebay and the ongoing restoration of tidal wetland in the Cache Slough and Suisun Marsh ROAs. However, 600 acres would be protected (CM3) and up to 67 acres would be restored (CM9) through the course of the Alternative 1A implementation. In addition, the avoidance and minimization measures listed above would reduce the actual loss of this community to no more than 10 wetted acres of vernal pool crustacean habitat (an estimated 67 acres of vernal pool complex natural community) from direct activities and 20 acres of crustacean habitat from indirect effects.

NEPA Effects**:** The conservation measures associated with Alternative 1A include protection of 400 acres (CM3) and restoration of an estimated 40 acres (CM9) of vernal pool complex in the near-term time frame. The Plan focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). In addition, Alternative 1A includes AMM12 which limits the removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. With this and other AMMs in place, the BDCP would not adversely affect vernal pool complex natural community in the near-term. With these conservation measures and AMMs in effect through the entire Plan period, Alternative 1A would not have an adverse effect on the vernal pool complex natural community in the long term.

CEQA Conclusion:

Near-Term Timeframe

During the 10-year near-term time frame, Alternative 1A could result in the loss of approximately 204 acre of vernal pool complex natural community due to inundation during water conveyance facilities construction (CM1) and tidal marsh restoration (CM4). The losses would likely occur in the Cache Slough or Suisun Marsh ROAs, and immediately adjacent to Clifton Court Forebay. The construction and inundation-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (with a commitment to keep pace with actual losses) as part of CM9 during the first 10 years of Alternative 1A implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 408 acres of protection and 204 acres of restoration would be needed to offset (i.e., mitigate) the 204 acres of loss. Without additional avoidance and minimization measures to reduce the potential impact, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. However, Alternative 1A also includes AMM1, AMM2, AMM3, AMM4, AMM10, AMM12 and AMM30 to minimize impacts. AMM12 places a strict limit on the acres of wetted vernal pool crustacean habitat that can be lost to conservation actions (10 acres of direct and 20 acres of indirect loss; equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool complex, respectively). Because of the offsetting protection and restoration activities and implementation of the AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 375 acres of vernal pool complex natural community could be permanently removed. Through CMs 3 and 9, 600 acres of vernal pool complex natural community would be protected and up to 67 acres would be restored. In addition, AMM12 would limit the acres of wetted vernal pool crustacean habitat loss to 10 acres from direct actions and 20 acres from indirect actions. These wetted acres are equivalent to approximately 67 acres and 134 acres of vernal pool complex, respectively. There would be no net permanent reduction in the acreage of this natural community within the study area. Alternative 1A would have a less-than-significant impact on this natural community.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, could increase periodic inundation of a small acreage of vernal pool complex natural community in the southern section of the bypass, south of Putah Creek.

Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency and duration of inundation on an estimated 0–4 acres of vernal pool complex natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 4-acre increase in inundation would only occur at the highest modeled flow regime, 8,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The vernal pool complex natural community that would likely be affected occurs primarily in the southern reaches of the bypass, south of Putah Creek. There are several relatively large, contiguous areas of vernal pools on the western edge of the bypass in this area. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1A water operations would not adversely affect vernal pool complex habitats, as they have persisted under similar high flows and extended flow periods. There is the potential, however, for some change in plant species composition as a result of longer inundation periods.

CEQA Conclusion: An estimated 0–4 acres of vernal pool complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1A. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of vernal pool complex natural community in the Yolo Bypass would have a less-than-significant impact on the community.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational activities in Plan reserves. These actions are associated with CM1 and CM11 (see Impact BIO-22 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the major Sacramento River system and Delta waterways.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as part of (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11 describes this program and identifies applicable restrictions on recreation that might adversely affect vernal pool habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, AMM30 and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation or damage from recreational activity. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12, AMM30 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9*

Vernal Pool and Alkali Seasonal Wetland Complex Restoration and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Managed Wetland

The conservation components of Alternative 1A would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (Table 12-1A-9). Full implementation of Alternative 1A would also include the following conservation action over the term of the BDCP to benefit the managed wetland natural community.

- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3)
- Create at least 320 acres of managed wetlands consisting of greater sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in Conservation Zones 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events (Objective GSHC1.3, associated with CM10).
- Create two wetland complexes within the SLNWR refuge boundary. Each complex would consist of at least three wetlands totaling 90 acres of greater sandhill crane roosting habitat. One of the wetland complexes may be replaced by 180 acres of cultivated lands that are flooded following harvest for crane roosting and foraging habitat (Objective GSHC1.4, associated with CM10).

In addition to this conservation action, creation of similar habitat values by restoring tidal brackish emergent wetland and tidal freshwater emergent wetland as part of CM4 would further offset the losses of managed wetland. The net effect would be a substantial decrease in the amount of managed wetlands, but an increase in similar habitat value for special-status and common species as the managed wetland is converted to tidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to Impacts BIO-178 through BIO-183 in the *Shorebirds and Waterfowl* discussion at the end of this section (Section 12.3.3.2) for further consideration of the effects of removing managed wetland natural community.

Table 12-1A-9. Changes in Managed Wetland Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	3	3	83	83	0	0
CM2	24	24	44	44	931–2,612	0
CM4	5,718	12,786	0	0	0	0
CM5	0	0	0	0	0	6
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**5,745**	**12,813**	**127**	**127**	**931–2,612**	**6**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 12,813 acres of managed wetland in the study area. This modification represents approximately 18% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur through the course of the BDCP restoration program, as construction activity and tidal marsh restoration proceeds. Managed wetland protection (8,100 acres) and restoration (500 acres) would take place over the same period, but would not replace the acreage lost. The BDCP beneficial effects analysis for Alternative 4 (BDCP Chapter 5, Section 5.4.9.2) states that at least 8,100 acres of managed wetlands would be protected, of which at least 1,500 acres would be located within the Grizzly Island marsh complex, consistent with the U.S. Fish and Wildlife Service salt marsh harvest mouse recovery plan. Although the primary purpose of the 1,500 acres of protection is to protect and enhance habitat for the salt marsh harvest mouse, it is also expected to benefit the managed wetland natural community and the diversity of species that use it, including migratory waterfowl and the western pond turtle. These same conservation actions would be implemented with Alternative 1A.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 3 acres and temporarily remove 83 acres of managed wetland community. The permanent loss would occur primarily on the southeastern side of Tyler Island, adjacent to the North Mokelumne River where a permanent access road to a tunnel shaft site would be constructed. Small permanent losses could also occur where transmission lines are constructed across Mandeville Island. A barge unloading facility, batch plant and tunnel work area would create temporary effects on southeastern Tyler Island, but the main temporary loss would occur immediately west of Stone Lakes National Wildlife Refuge, between Intakes 1 and 2. A large spoil and borrow area is planned at this location (see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities that could permanently or temporarily remove managed wetland, including west side channels modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in managed wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently removed and 44 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 12,813 acres of managed wetland community. These losses would be expected to occur primarily in the Suisun Marsh ROA, but could also occur in the Cache Slough and West Delta ROAs (see Figure 12-1). These acres of managed wetland would be converted to natural wetland, including large acreages of tidal brackish emergent wetland and tidal freshwater emergent wetland. These natural wetlands provide comparable or improved habitat for the special-status species that occupy managed wetland. The newly created tidal marsh would not create a barrier or result in fragmentation of managed wetland, as most species are capable of utilizing both communities. An estimated 500 acres of managed wetland would be restored and 8,100 acres would be enhanced and protected through *CM3 Natural Communities Protection and Restoration,* as established by BDCP Objective NWNC1.1. All of the restoration and 4,800 acres of the protection would happen during the first 10 years of Alternative 1A implementation, which would coincide with the timeframe of water conveyance facilities construction and early implementation of CM4. The remaining restoration would be spread over the following 30 years. Managed wetland restoration is expected to include 500 acres in CZs 3, 4, 5, and 6 to benefit sandhill crane, as stated in BDCP Objectives GSHC1.3 and GSHC1.4 (Figure 12-1). The enhancement and protection would be focused in Suisun Marsh, but could also occur in CZs with existing managed wetland (CZs 1, 2, 4, 5, 6, and 7).

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would permanently remove 5,745 acres and temporarily remove 127 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Three acres of the permanent loss and 83 acres of the temporary loss would be associated with construction of the water conveyance facilities (CM1). These near-term losses would occur in various locations, but the majority of the near-term loss would occur immediately east of Stone Lakes National Wildlife Refuge for spoil and borrow activity, and in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 and CM10 during the first 10 years of Alternative 1A implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 86 acres of protection would be needed to offset the 86 acres of loss associated with CM1; a total of 5,872 acres of protection would be needed to offset (i.e., mitigate) the 5,872 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 572 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetlands lost. Mitigation measures would also be implemented to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1A, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be an adverse effect when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this adverse effect. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

Late Long-Term Timeframe

At the end of the Plan period, 12,813 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland.

NEPA Effects: During the near-term timeframe, Alternative 1A would permanently remove 5,745 acres and temporarily remove 127 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Through the course of Plan implementation, Alternative 1A would result in a permanent loss of 12,813 acres of managed wetland within the study area; however, it would also protect and enhance 8,100 acres and restore 500 acres of this habitat. In addition, Alternative 1A would restore 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland that support similar ecological functions to those of managed wetland. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion:

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would permanently remove 5,745 acres and temporarily remove 127 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Eighty-six acres of this loss (including temporary and permanent effects) would be associated with construction of the water conveyance facilities (CM1). These losses would occur in various locations, but the majority of the near-term loss would occur immediately east of Stone Lake National Wildlife Refuge from borrow and spoil activity, and in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 and CM10 during the first 10 years of Alternative 1A implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 86 acres of protection would be needed to offset the 86 acres of loss associated with CM1; a total of 5,872 acres of protection would be needed to offset (i.e., mitigate) the 5,872 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 572 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be implemented to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1A, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be a significant impact when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would eliminate this significant impact. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the impacts of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Late Long-Term Timeframe

At the end of the Plan period, 12,813 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland. Because these natural wetlands support similar ecological functions to those of managed wetland, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of managed wetland on wildlife management areas and duck clubs scattered up and down the central and southern bypass. CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways in the south Delta.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency and duration of inundation of 931-2,612 acres of managed wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 931-acre increase in inundation would be associated with a notch flow of 8,000 cubic feet per second (cfs), and the 2,612-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Based on the theoretical modeling that has been completed to-date, the largest acreages would be associated with the Sacramento Bypass Wildlife Area, the Yolo Bypass Wildlife Area, and private managed wetlands south of Putah Creek. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). With larger flows, the water depth may also increase over Existing Conditions. While the managed wetlands of the Yolo Bypass are conditioned to periodic inundation events, the more frequent and extended inundation periods may make it more difficult to actively manage the areas for maximum food production for certain species (waterfowl primarily) and may alter the plant assemblages in some years. The effects of the periodic inundation on birds and other terrestrial species are discussed later in this chapter. The additional inundation would not be expected to reduce the acreage of managed wetland on a permanent basis. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency, magnitude and duration of inundation of an estimated 6 acres of managed wetland. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The connection of these wetlands to stream flooding events would be beneficial to the ecological function of managed wetlands, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The more frequent flooding would periodically interfere with management activities associated with terrestrial species (primarily waterfowl) and may result in changes in plant composition and management strategies over time.

In summary, 937–2618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1A conservation measures (CM2 and CM5).

NEPA Effects: Managed wetland community would not be adversely affected because much of the acreage affected is conditioned to periodic inundation. The more frequent inundation could create management problems associated with certain species, especially waterfowl, and result in changes over time in plant species composition. The total acreage of managed wetland would not be expected to change permanently as a result of periodic inundation.

CEQA Conclusion: An estimated 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. Managed wetland community would not be significantly impacted because periodic inundation is already experienced by most of the land that would be affected. There could be increased management problems and a long-term shift in plant species composition. The periodic inundation would not be expected to result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the above impact discussion for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use managed wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow hunting, fishing and hiking in managed wetland reserve areas. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management, and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in acreage of managed seasonal wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and *CM4 Tidal Natural Communities Restoration,* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the natural community.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7 (Figure 12-1). The only Alternative 1A conservation component that would potentially affect this natural community is the seasonally inundated floodplain restoration conservation measure (CM5) (see Table 12-1A-10).

Table 12-1A-10. Changes in Other Natural Seasonal Wetland Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	0	0	0	0	0	0
CM5	0	0	0	0	0	2
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**2**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Based on theoretical footprints for this activity, *CM5 Seasonally Inundated Floodplain Restoration* could expose 2 acres of other natural seasonal wetland community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels, including the channels of Old River and Middle River. Small patches of other natural seasonal wetland natural community are mapped along these waterways. The exposure of these seasonal wetlands to increased but infrequent episodes of stream flooding would not alter their ecological function or species composition. Their value to special-status and common plants and wildlife in the study area would not be affected. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

NEPA Effects: Alternative 1A conservation actions would not adversely affect other natural seasonal wetland natural community because the small increase in periodic flooding of up to 2 acres would not alter its function or general species makeup.

CEQA Conclusion: An estimated 2 acres of other natural seasonal wetland community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing CM5 under Alternative 1A. This community would not be significantly impacted because a small increase in periodic flooding would not alter its ecological function or species composition. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Restoration.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared with the restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool complex conservation measure includes restoration of 139 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Grassland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1A would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would result in both permanent and temporary removal of this community (see Table 12-1A-11). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the grassland natural community.

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in Conservation Zone 1, at least 1,000 acres protected in Conservation Zone 8, and at least 2,000 acres protected in Conservation Zone 11 (Objective GNC1.1, associated with CM3)
- Restore at least 2,000 acres of grasslands to connect fragmented patches of protected grassland and to provide upland habitat adjacent to riparian, tidal, and nontidal natural communities for wildlife foraging and upland refugia (Objective GNC1.2, associated with CM3 and CM8)
- Of the at least 8,000 acres of grassland protected and at least 2,000 acres of grassland restored, protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation (Objective GNC1.4, associated with CM3 and CM8)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of grassland natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-11. Changes in Grassland Natural Community Associated with Alternative 1A (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	315	315	262	262	0	0
CM2	388	388	239	239	385–1,277	0
CM4	448	1,122	0	0	0	0
CM5	0	51	0	34	0	514
CM6	Unk.	Unk.	Unk.	Unk.	0	0
CM7	4	410	0	0	0	0
CM11	13	50	0	0	0	0
CM18	35	35	0	0	0	0
TOTAL IMPACTS	**1,203**	**2,371**	**501**	**535**	**385–1,277**	**514**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would permanently eliminate an estimated 2,371 acres and temporarily remove 535 acres of grassland natural community in the study area. These modifications represent approximately 4% of the 78,047 acres of the community that is mapped in the study area. Approximately 60% of the permanent and temporary losses would occur during the first 10 years of Alternative 1A implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Grassland protection (2,000 acres), restoration (1,140 acres) and enhancement would be initiated during the same period. By the end of the Plan period, 2,000 acres of this natural community would be restored and 8,000 acres would be protected. The BDCP beneficial effects analysis for grassland (BDCP Chapter 5, Section 5.4.11.2) indicates that at least 8,000 acres of grasslands would be protected in Conservation Zones 1, 2, 4, 5, 7, 8, and 11, and 2,000 acres of grassland would be restored. Grassland protection and restoration would improve connectivity among habitat areas in and adjacent to the Plan Area, improve genetic interchange among native species' populations, and contribute to the long-term conservation of grassland-associated covered species. These same conservation activities would occur through implementation of Alternative 1A.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1A water conveyance facilities would permanently remove 315 acres and temporarily remove 262 acres of grassland natural community. Most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland, at various locations along the north-south transmission line corridor, and at the southern forebay adjacent to Clifton Court Forebay. The ruderal and herbaceous grassland areas along the Sacramento River are very narrow bands adjacent to the road and the levee that borders the river (see Terrestrial Biology Mapbook). The grassland lost at the southern forebay and the adjacent spoils storage area is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland. A smaller acreage of permanent loss would occur at an RTM storage site on Andrus Island, and at the northern forebay just west of Stone Lake. The temporary losses would be associated with construction of the pump stations along the Sacramento River, pipelines connecting the intakes with the northern forebay, and work associated with barge offloading facility construction. The temporary pipeline construction losses would be located in the vicinity of Hood and along Snodgrass Slough. The temporary barge unloading facility impacts would occur along Middle River at Bacon Island, and along North Victoria Canal between Woodward and Victoria Islands. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Toe Drain/Tule Canal and Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in grassland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 388 acres could be permanently lost and another 239 acres could be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir where a large expanse of grassland is present, along the Toe Drain/Tule Canal, and along the west side channels. These grasslands are composed primarily of upland annual grassland and forbs. Some of this grassland removal along the side channels of the bypass could pose barriers to grassland species moving within the bypass. These losses would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 448 acres of grassland in the near-term and inundate or remove 1,122 acres of grassland by the end of the Plan timeframe. The losses would occur in a number of ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Most of this grassland is ruderal and herbaceous vegetation with low habitat value; some of the larger patches of grassland in the Cache Slough ROA are annual grassland with higher values.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 51 acres and temporarily remove 34 acres of grassland natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). The grassland in this area is primarily

composed of narrow bands and small patches of ruderal herbaceous grasses and forbs. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration;* Riparian natural community restoration would occur in a variety of settings in the Plan Area, with an emphasis on improving connectivity of existing riparian areas and stream/river corridors, to benefit the movement and interchange of special-status and common species that use these areas. Large tracts would be restored in concert with floodplain restoration (CM5), while narrower bands would be developed as part of channel margin enhancement (CM6) and tidal marsh restoration (CM4). In the process of expanding woody riparian habitat, existing nonnative grassland would be removed. While specific locations for these restoration activities have not been fully developed, use of theoretical footprints for this activity indicate that up to 410 acres of grassland could be lost through the course of Alternative 1A implementation. A majority of this activity would occur in the South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).
- *CM8 Grassland Natural Community Restoration*: The grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZs 1, 8, and 11, as proposed by BDCP Objective GNC1.1 (Figure 12-1), with a goal of improving habitat connectivity and increasing the diversity of grassland species (Objective GNC1.2). Some of the planned 2,000 acres of restoration would occur around existing populations of giant garter snake in the east Delta and the Yolo Bypass area.
- *CM11 Natural Communities Enhancement and Management:* Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the BDCP. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public's ability to participate in recreational activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known, so the analysis of this activity is programmatic. At the current level of planning, it is assumed that the trail system would be located entirely in grassland habitats and would include up to 50 acres of habitat loss.
- *CM18. Conservation Hatcheries:* The BDCP includes a proposal to design and construct a conservation hatchery to maintain populations of delta smelt and longfin smelt. The location of this facility is not yet firmly established, but for planning purposes it has been assumed that it would be constructed in the vicinity of Rio Vista and would be located in grassland habitat. The grassland in the Rio Vista area includes both California annual grassland and ruderal herbaceous grasses and forbs. The current estimate of the land needed for this facility is 35 acres.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1A would affect the grassland natural community through CM1 construction losses (315 acres permanent and 262 acres temporary), CM2 construction losses (388 acres permanent and 239 acres temporary), CM11 recreational trail construction (13 acres permanent), CM18 fish hatchery construction (35 acres permanent), and CM7 riparian habitat restoration (4 acres permanent). These losses would occur primarily along the eastern bank of the Sacramento River at intake sites, along pipeline routes connecting these intakes to the northern forebay, at various locations along the north-south transmission line corridor, at the southern forebay, at currently unspecified sites for hatchery and recreational trail construction and riparian restoration, in the northern Yolo Bypass, and along the east and west channels within the Yolo Bypass. Approximately 488 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see BDCP Chapter 3, *Conservation Strategy*). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses later in this chapter. The combination of restoring 1,140 acres (CM8) and protecting 2,000 acres (CM3) of grassland natural community during the first 10 years of Alternative 1A implementation, and the commitment to restore temporarily affected grassland (501 acres) to its pre-project condition within 1 year of completing construction as required by *AMM10 Restoration of Temporarily Affected Natural Communities*, would offset this near-term loss, avoiding any loss in the value of this habitat for special-status species. The restoration of grassland would include protection in perpetuity, and the protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (CM3 and CM11). Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,408 acres of protection would be needed to offset (i.e., mitigate) the 1,704 acres of combined temporary and permanent loss. The combination of restoration and protection, along with the enhancement and management associated with CM3 and CM11 and the restoration of temporarily affected habitat (AMM10) contained in the BDCP is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM*6 *Disposal and Reuse of Spoils, AMM*7 *Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and disposal sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1A as a whole would result in less than 4% losses of grassland natural community in the study area. These losses (2,371 acres of permanent and 535 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and riparian habitat restoration (CM7). Inundation losses would occur through the course of BDCP restoration activities at various tidal restoration sites throughout the study area.

NEPA Effects: By the end of the Plan timeframe, a total of 2,000 acres of this natural community would be restored (CM8) and 8,000 acres would be protected (CM3). The restoration would occur primarily in CZ 1, CZ 8, and CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity. The 2,000 acres of restoration associated with CM8, and the restoration of temporarily affected grassland required by AMM10 (535 acres for Alternative 1A) would not totally replace the grassland acres lost through the Plan timeframe (2,856 acres). There would be a permanent loss of 321 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 1A would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1A would result in the loss of approximately 1,704 acres of grassland natural community due to construction of the water conveyance facilities (CM1), fish passage improvements (CM2), inundation during tidal marsh restoration (CM4), recreational trail construction (CM11), riparian habitat restoration (CM7), and fish hatchery construction (CM18). This total includes both permanent and temporary near-term losses listed in Table 12-1A-11. The construction losses would occur primarily along the Sacramento River at intake sites, along pipeline routes connecting these intakes to the northern forebay, at the southern forebay, at currently unspecified sites for hatchery and recreational trail construction and riparian restoration, and within the northern section of the Yolo Bypass, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Nonetheless, these losses would be offset by planned restoration of 1,140 acres, and protection of 2,000 acres of grassland natural community scheduled for the first 10 years of Alternative 1A implementation, and the restoration of temporarily affected grassland (501 acres for Alternative 1A) as dictated by AMM10. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,408 acres of protection would be needed to offset (i.e., mitigate) the 1,704 acres of loss. The combination of two approaches (protection and restoration) contained in the BDCP conservation measures and avoidance and minimization measures are designed to avoid a temporal lag in the value of grassland habitat available to special-status species. The protection and restoration would be initiated at the beginning of Alternative 1A implementation to minimize any time lag in the availability of this habitat to special-status species.

Late Long-Term Timeframe

At the end of the Plan period, 2,906 acres of grassland natural community would be permanently or temporarily removed by conservation actions, 2,000 acres would be restored and 8,000 acres would be protected. Temporarily affected areas would also be restored (535 acres for Alternative 1A). While there would be a net permanent reduction in the acreage of this natural community within the study area (total loss of 321 acres), there would be an increase in the value of grassland for special-status and common species in the study area through the combination of conservation actions (CM3 and CM8) and avoidance and minimization measures (AMM1, AMM2, AMM6, AMM7, and AMM10). Therefore, Alternative 1A would have a less-than-significant impact on this natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Two Alternative 1A conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of grassland natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1A would result in an increase in the frequency, magnitude and duration of inundation of 385–1,277 acres of grassland natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 385-acre increase in inundation would occur at the 1,000 cfs flow regime, while the 1,277-acre increase would occur at the 4,000 cfs flow regime. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The grassland community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass, in stringers along the internal waterways of the bypass and in larger patches in the lower bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect grassland habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in grass species composition as a result of longer inundation periods. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 514 acres of grassland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The increase in periodic stream flooding events would not adversely affect the habitat values and functions of grassland natural community.

In summary, 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1A conservation measures (CM2 and CM5).

***NEPA Effects*:** The grassland community in the Yolo Bypass and along river floodplains in the south Delta are conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would not constitute an adverse effect.

***CEQA Conclusion*:** An estimated 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1A. The grassland natural community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would have a less-than-significant impact on the community.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include changes in releases from upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-30 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM8 Grassland Natural Community Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 1A would not result in a net permanent reduction in grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1A would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM8 Grassland Natural Community Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community includes approximately 20 acres of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1). While this community is within the BDCP Plan Area, none of the Alternative 1A conservation measures or covered actions are expected to affect it.

Cultivated Lands

Cultivated lands is the major land-cover type in the study area (487,106 acres; see Table 12-1). The Delta, the Yolo Bypass, and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 list special-status plant and wildlife species supported by cultivated lands.

The effects of Alternative 1A on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species later in this chapter also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses below, there is no separate analysis of this land cover type presented here. Table 14-8 in Chapter 14 provides a comparison of important farmland losses that would result from construction of CM1 water conveyance facilities for each alternative, and Table 14A-1 in Appendix 14A, *Individual Crop Effects as a Result of BDCP Water Conveyance Facility Construction,* provides a similar comparison for losses of individual crops. Table 12-ES-1 in this chapter's Summary of Effects identifies the total cultivated land loss for all project alternatives. For Alternative 1A, the total loss (temporary and permanent) is estimated to be 58,369 acres. The majority of the permanent loss would be associated with habitat restoration activities, including Yolo Bypass fisheries enhancement (CM2; 629 acres), tidal marsh restoration (CM4; 39,565 acres), floodplain restoration (CM5; 2,087 acres), riparian natural community restoration (CM7; 960 acres), grassland restoration (CM8; 2,000 acres) and nontidal marsh restoration (CM10; 1,950 acres). Construction of the tunnel and associated water conveyance facilities (CM1) would permanently remove 3,836 acres of cultivated land.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized here as developed lands (90,660 acres). Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities. Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap. As with cultivated lands, no effort has been made to analyze the effects of BDCP covered actions on this land cover type. It is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants. These areas do not include topographic depressions that are characteristic of vernal pool crustacean habitat and, thus, are considered to have a lower value for the species.

Construction and restoration associated with Alternative 1A conservation measures would result in permanent losses (see Table 12-1A-12) and indirect conversions of vernal pool crustacean modeled habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit vernal pool crustaceans (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (Objective VPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)
- Protect one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

As explained below, with the restoration or protection of these amounts of habitat, in addition to AMMs to minimize potential effects, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-12. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	1	1	0	0	NA	NA
	Low-value	2	2	0	0	NA	NA
Total Impacts CM1		**3**	**3**	**0**	**0**	**NA**	**NA**
CM2–CM18	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**204**	**375**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 1A conservation measures would result in the direct, permanent loss of up to 375 acres of modeled vernal pool crustacean habitat from conveyance facilities construction (CM1) and tidal restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 142 acres of vernal pool crustacean habitat (91 acres of high-value habitat and 51 acres of low-value habitat) from conveyance facilities construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 1A would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool fairy shrimp (270 acres), and vernal pool tadpole shrimp (270 acres). The hypothetical tidal restoration (CM4) footprints in CZ 11 account for all of the effects on critical habitat for these species. *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites will be selected and restoration projects designed to minimize or avoid effects on the covered vernal pool crustaceans. As specified in the *AMM12 Vernal Pool Crustaceans* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities will be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which includes an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is comprised of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of 3 acres of vernal pool crustacean habitat, composed of 1 acre of high-value and 2 acres of low-value habitat (Table 12-1A-12). In addition, conveyance facility construction could result in the indirect conversion of 8 acres of modeled vernal pool crustacean habitat in the vicinity of Clifton Court Forebay. The affected area consists of 2 acres of high-value and 6 acres low-value habitat. There are no records of listed vernal pool crustaceans at these locations but there are records for vernal pool fairy shrimp and midvalley fairy shrimp in the vicinity of these areas (California Department of Fish and Wildlife 2013).

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool crustacean habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool crustaceans as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Wildlife 2013). Helm (1998) notes that many vernal pool crustaceans can occur in degraded vernal pool habitats and artificial habitats. In CZs 2 and 4, there are several records of covered vernal pool crustaceans occurring outside of modeled habitat in areas that appear to be road side ditches. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool crustaceans and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool crustacean habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool crustacean habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. The hypothetical restoration footprints overlap with a CNDDB record for vernal pool fairy shrimp near the current edge of Suisun Marsh. Tidal natural community restoration under Alternative 1A would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool tadpole shrimp (270 acres), and vernal pool fairy shrimp (270 acres). *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration and creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool crustaceans (Table 12-1A-12). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values over the term of the BDCP. Human presence for recreation activities could result in the injury, mortality of, and/or degreation of habitat for vernal pool crustaceans through trampling pool edges, increased turbidity, unauthorized collection, and introduction of trash. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-1A-13 was prepared to further analyze Alternative 1A effects on vernal pool crustaceans using wetted acres of vernal pools in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-1A-13. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 1A (acres)

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 1A Impact[b]	CM1	0.5	0.5	1.2	1.2
	CM4[c]	30.2	55.8	11.0	20.3
Total		**30.7**	**56.3**	**12.2**	**21.5**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1A-12 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and will likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool crustacean habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term values would be.

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1A-12 above lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans. As seen in Table 12-1A-13, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1A-13, Alternative 1A would not meet the Plan's near-term biological goals and objectives for direct loss and indirect conversion unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.5 wetted acre of vernal pool crustacean habitat (or 3 acres of complex using the 15% density) should be restored and 3.4 acres (or 23 acres of complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1A-13, impacts on wetted vernal pool crustacean habitat resulting from tidal restoration in the near-term could not exceed 4.5 wetted acres direct and 8.8 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of complex) and protect up to 30 wetted acres (200 acres of complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1A-13, the effects of CM1 alone would be well within the near-term limits but overall Alternative 1A would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

NEPA Effects: The near-term loss of vernal pool crustacean habitat under Alternative 1A would not be adverse because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the modification of vernal pool crustacean habitat and potential mortality of special-status species resulting from Alternative 1A in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, losses and conversion of vernal pool crustacean habitat under Alternative 1A would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term Alternative 1A conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-1A-12 above lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans. As seen in Table 12-1A-13, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1A-13, Alternative 1A would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.5 wetted acre of vernal pool crustacean habitat (or 3 acres of vernal pool complex using the 15% density) should be restored and 3.4 acres (or 23 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1A-13, impacts on wetted vernal pools resulting from tidal restoration in the near-term could not exceed 4.5 wetted acres direct and 8.8 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration will be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 11,040 acres of vernal pool The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1A-13, the effects of CM1 alone would be well within the near-term limits but overall Alternative 1A would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

In the absence of other conservation actions, the effects on vernal pool crustacean habitat from Alternative 1A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to the habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, Alternative 1A over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 1A would have a less-than-significant impact on vernal pool crustaceans.

Impact BIO-33: Indirect Effects of Plan Implementation on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of Alternative 1A implementation would not be adverse

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase. The indirect impacts of Alternative 1A would be less than significant.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled vernal pool crustacean habitat (Table 12-1A-12). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect vernal pool crustaceans occupying areas ranging from 0 acres of habitat during most notch flows, to an estimated 4 acres during a notch flow of 6,000 cubic feet per second. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus not be adverse under NEPA.

CEQA Conclusion: Alternative 1A would periodically inundate a maximum of 4 acres of vernal pool crustacean habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of vernal pool crustacean habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus result in less-than-significant impacts on the species.

Valley Elderberry Longhorn Beetle

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation measures, on the valley elderberry longhorn beetle. That habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (vernal pool complexes and grasslands within 200 feet of channels). Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-1A-14. The majority of the losses would take place over an extended period of time as the restoration conservation measures are being implemented. In addition, an estimated 21 elderberry shrubs could be impacted by Alternative 1A conveyance alignment (CM1). Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit valley elderberry longhorn beetle (BDCP Chapter 3, *Conservation Strategy*).

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines for the species (Objective VELB1.1).
- Site elderberry longhorn beetle habitat restoration adjacent to occupied habitat (Objective VELB1.2).
- Restore 5,000 acres of valley/foothill riparian (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of valley/foothill riparian (Objective VFRNC1.2, associated with CM3).
- Maintain or increase the abundance and distribution of rare or uncommon vegetation alliances, such as *Sambuca nigra* (blue elderberry stands) alliance (Objective VFRNC3.1, associated with CM7 and CM11).

As explained below, with the restoration or protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-14. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	58	58	28	28	NA	NA
	Non-riparian	192	192	73	73	NA	NA
Total Impacts CM1		**250**	**250**	**101**	**101**		
CM2–CM18	Riparian	381	678	76	111	44–80	266
	Non-riparian	142	311	94	108	103–244	287
Total Impacts CM2–CM18		**523**	**989**	**170**	**219**	**161–325**	**553**
TOTAL IMPACTS		**773**	**1,240**	**271**	**320**	**161–325**	**553**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 1A conservation measures would result in the permanent and temporary loss combined of up to 1,560 acres of modeled valley elderberry longhorn beetle habitat (875 acres of riparian habitat and 685 acres of nonriparian habitat), and an estimated 21 elderberry shrubs from CM1, which represent potential habitat for the species (Table 12-1A-14). Due to the limitation of the habitat suitability model, all of these effects are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Timely implementation of the near-term habitat protection and restoration contained in the Plan and implementation of AMMs committed to in the Plan would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent and temporary combined loss of approximately 351 acres of modeled valley elderberry longhorn beetle habitat, composed of 86 acres of riparian habitat and 265 acres of nonriparian habitat (Table 12-1A-14). In addition, an estimated 21 shrubs could be potentially removed as a result of conveyance facility construction. The exact number of shrubs to be impacted will be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 101 acres of modeled valley elderberry longhorn beetle habitat (28 acres riparian and 73 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, temporary access roads, and staging areas.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 295 acres of modeled valley elderberry longhorn beetle habitat, composed of 159 acres of riparian habitat and 135 acres of nonriparian habitat. Approximately 125 acres of permanent impacts (83 acres of riparian and 41 acres of nonriparian) would mostly occur at the north end of the Yolo Bypass from Fremont Weir improvements. The 224 acres of temporary impacts (76 acres of riparian and 94 acres of nonriparian) would mostly be from work on the Freemont Weir, the Sacramento Weir, and levees along the Bypass. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee modification, and removal of riprap and other protections from channel banks.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 813 acres of modeled valley elderberry longhorn beetle habitat, composed of 552 acres of riparian and 260 acres of nonriparian habitat. The majority of these impacts would be associated with tidal restoration in the Delta and only 42 acres of these impacts (all nonriparian) would be from tidal restoration in Suisun Marsh. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 101 acres of valley elderberry longhorn beetle habitat, composed of 78 acres of riparian and 23 acres of nonriparian. Approximately half of these impacts (52 acres) would be permanent impacts from levee construction and the other half (49 acres) would be temporary impacts associated with the levee construction. There is one record of valley elderberry longhorn beetle occurring in CZ 7 just wet of Middle River on Union Island. This record and other elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of BDCP protected habitats for covered species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs discussed below.

- Operations and maintenance: Post construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could potentially affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs described below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1A would result in permanent and temporary impacts on 1,044 acres of modeled habitat (543 acres of riparian and 501 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 86 acres of riparian and 265 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 521 acres (88%) of impacts on riparian habitat. Based on limited DWR survey data of the Conveyance Planning Area (see Appendix 12C), an estimated 21 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified as habitat for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 86 acres of the riparian habitat should be restored/created and 86 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS (U.S. Fish and Wildlife Service 1999a) conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of CM7 *Riparian Natural Community Restoration*. CM7 *Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals and the additional species specific measures within CM7 satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigating the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities and the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 1,560 acres of modeled valley elderberry longhorn beetle habitat (875 acres of riparian habitat and 685 acres of nonriparian habitat) during the term of the Plan (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These loses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat (VRFNC1.2) and restoring/creating 5,000 acres of riparian habitat in the Plan Area (VFRNC1.1). According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. Other factors relevant to effects on valley elderberry longhorn beetle are listed below.

- Habitat loss is widely dispersed throughout the study area and will not be concentrated in any one location.
- There would be a temporal loss of riparian habitat during the near-term evaluation period because most of the affected riparian vegetation would be removed during the near-term timeframe, while large quantities of riparian habitat would not be restored until the early and late long-term timeframes. Effects on valley elderberry longhorn beetle of this temporal loss of riparian vegetation are expected to be minimal because much of the riparian habitat in the Plan Area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation will be moved to conservation areas in the Plan Area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the Plan Area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the conservation measures or other covered activities that would result in temporary effects on natural communities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

***NEPA Effects*:** The near-term loss of valley elderberry longhorn beetle habitat under Alternative 1A would not be an adverse effect because the BDCP has committed to restoring and protecting an acreage that exceeds the typical mitigation ratios described above in addition to avoiding impacts on shrubs and transplanting those that can't be avoided. In the absence of other conservation actions, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of special-status species associated with Alternative 1A in the late long-term would represent an adverse effect. However, with habitat protection and restoration associated with CM7, guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place during all project activities, the effects of Alternative 1A as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 1A would result in permanent and temporary impacts on 1,044 acres of modeled habitat (543 acres of riparian and 501 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These impacts would result from the construction of the water conveyance facilities (CM1, 86 acres of riparian and 265 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). Based on limited

DWR survey data of the Conveyance Planning Area, an estimated 21 elderberry shrubs would be impacted by CM1.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 86 acres of the riparian habitat should be restored/created and 86 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 0457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS (U.S. Fish and Wildlife Service 1999a) conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. CM7 specifically calls for the planting of elderberry shrubs in in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 would require surveys for elderberry shrubs within 100 feet of any ground disturbing activities and the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs, are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 1,560 acres of modeled valley elderberry longhorn beetle habitat (875 acres of riparian habitat and 685 acres of nonriparian habitat) during the term of the Plan (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These loses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat (VFRNC1.2) and restore or create 5,000 acres of riparian habitat in the Plan Area (VFRNC1.1). According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species ability to disperse within and outside the Plan Area. The BDCP also includes a number of AMMs (AMM1–AMM6, AMM10, and AMM15) directed at minimizing or avoiding potential impacts on valley elderberry longhorn beetle. The large acreages of conservation would adequately compensate for the modeled habitats lost to construction and restoration activities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, conservation components, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on valley elderberry longhorn beetle over the term of the BDCP. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis (see Section 12.3.2.3 for a discussion on the methods used to make this estimate) estimates that approximately 37shrubs could be indirectly affected by conveyance facilities construction (CM1). Restoration activities could result in excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15, which would be in effect throughout the Plan's construction phase.

NEPA Effects: The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 1A conservation actions would not have an adverse effect on valley elderberry longhorn beetle.

CEQA Conclusion: Ground-disturbing activities, stockpiling of soils, and the potential release of dust and hazardous substances would accompany construction of the water conveyance facilities. An estimated 37 shrubs could be indirectly affected by conveyance facilities construction (CM1). In addition, ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks could indirectly affected elderberry shrubs that occur within 100 feet of these restoration activities. With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 1A construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse indirect effects on valley elderberry longhorn beetle in that the Plan would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 161 to 325 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1A-14).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 553 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1A-14).

It is unknown at this time how much of the modeled habitat that will be inundated as a result of CM2 and CM5 actually contains elderberry shrubs. Elderberry shrubs have been found to be intolerant of long periods of inundation and there is evidence that they die very quickly after even short periods of flooding (River Partners 2008). During monitoring of a restoration project at the San Joaquin River National Wildlife Refuge, River Partners found that nearly all (99 to 100%) of the four year old elderberry shrubs in restoration plots died after 15-17 weeks of inundation and they noted in general that the shrubs died very quickly after even short periods of flooding (River Partners 2008). Talley et al (2006) in their report assisting the USFWS 5-year review of the species, note that elderberry shrubs respond negatively to saturated soil conditions and that they can only tolerate temporary root crown inundation. Therefore, in the areas that would be periodically inundated by the implementation of CM2 it is likely that there are few, if any, mature shrubs in these areas because under current conditions they would be inundated in about 50% of all years for approximately 7 weeks. The areas affected by CM5 are not currently inundated and thus elderberry shrubs could be present in these areas.

The periodic effects on modeled habitat for valley elderberry longhorn beetle associated with implementing Alternative 1A could adversely affect valley elderberry longhorn beetle habitat (elderberry shrubs) and make modeled habitat there unsuitable for future elderberry establishment. Based on the information presented above, the current conditions in those areas that would be periodically inundated in Yolo Bypass (CM2) are not likely very suitable for elderberry shrubs and, thus, CM2 would likely have minimal effects, if any, on the species. The modeled habitat that would be periodically inundated from the implementation of CM5 could result in adverse effects on valley elderberry longhorn beetle.

NEPA Effects: Periodic effects of the inundation of valley elderberry longhorn beetle habitat as a result of implementing Alternative 1A conservation actions would not be adverse when taking into consideration CM7 habitat protection and restoration. This habitat protection and restoration would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the time period that periodic effects would occur.

CEQA Conclusion: Alternative 1A (CM2 and CM5) would have periodic impacts on modeled valley elderberry longhorn beetle habitat. The periodic inundation of between 161 and 325 acres (CM2) and 553 acres (CM5) of modeled habitat could result in the death of elderberry shrubs that may occur there and thus potentially impact valley elderberry longhorn beetle. The Plan includes the restoration of 5,000 acres of riparian habitat, and the protection of 750 acres riparian habitat (CM7) would include areas for elderberry restoration and protection. The BDCP also includes AMM1–AMM6, AMM10, and AMM15, which would minimize and avoid impacts on valley elderberry longhorn beetle prior to Yolo Bypass fisheries enhancement and floodplain restoration activities. AMM15, which includes measure for following the USFWS conservation guidelines for valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999a), would be used to identify shrubs for transplanting to conservation areas that otherwise could be adversely affected by periodic inundation in Yolo Bypass and floodplain restoration areas. These conservation actions would compensate for the periodic impacts on valley elderberry longhorn beetle.

Considering these protection and restoration provisions and avoidance and minimization measures, implementation of Alternative 1A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, periodic effects of inundation resulting from Alternative 1A would have a less-than-significant impact on valley elderberry longhorn beetle.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on other, vernal pool invertebrates that are not covered by the Plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants. These areas do not include topographic depressions that are characteristic of vernal pools and, thus, are considered to have a lower value for the species.

Construction and restoration associated with Alternative 1A conservation measures would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-1A-15 and indirect conversions of vernal pool habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1A also include the following conservation actions over the term of the BDCP that would benefit nonlisted vernal pool invertebrates (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (ObjectiveVPNC1.1, associated with CM3).

- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (ObjectiveVPNC1.3).
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4).
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would not be adverse for NEPA purposes and would be less-than significant for CEQA purposes.

Table 12-1A-15. Changes in Other Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	1	1	0	0	NA	NA
	Low-value	2	2	0	0	NA	NA
Total Impacts CM1		**3**	**3**	**0**	**0**	**NA**	**NA**
CM2–CM18	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**201**	**375**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 1A conservation measures would result in the permanent loss of up to 375 acres of vernal pool habitat from conveyance facilities construction (CM1) and tidal restoration (CM4). In addition, the conservation measures could result in the indirect conversion of an additional 142 acres of vernal pool habitat (91 acres of high-value habitat and 51 acres of low-value habitat) from conveyance facilities construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute an indirect effect unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites will be selected and restoration projects designed to minimize or avoid effects on the vernal pools. As specified in the BDCP, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pools are permanently lost. *AMM12 Vernal Pool Crustaceans* would ensure that no more than 20 wetted acres of vernal pools are indirectly affected by BDCP covered activities.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of 3 acres of nonlisted vernal pool invertebrate habitat, composed of 1 acre of high-value and 2 acres of low-value habitat (Table 12-1A-15). In addition, conveyance facility construction could result in the indirect conversion of 8 acres of modeled habitat in the vicinity of Clifton Court Forebay. The affected area consists of 2 acres of high-value and 6 acres low-value habitat. There are no records of these nonlisted vernal pool invertebrates within the impact footprint (California Department of Fish and Wildlife 2013).
- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool species as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Wildlife 2013). So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool invertebrates and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool invertebrate habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. No records of nonlisted vernal pool invertebrates would be directly impacted.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool invertebrates (Table 12-1A-15). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-1A-16 was prepared to further analyze Alternative 1A effects on nonlisted vernal pool invertebrates using wetted acres of vernal pools in order to compare to the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that vernal pool complexes support a 15% density of vernal pools.

Table 12-1A-16. Estimated Effects on Wetted Nonlisted Vernal Pool Invertebrate Habitat under Alternative 1A (acres)

		Direct		Indirect	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 1A Impact[b]	CM1	0.5	0.5	1.2	1.2
	CM4[c]	30.2	55.8	11.0	20.3
Total		**30.7**	**56.3**	**12.2**	**21.52**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1A-15 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and will likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term values would be.

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1A-15 above lists the impacts on nonlisted vernal pool invertebrate habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools (see AMM12). As seen in Table 12-1A-16, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1A-16, Alternative 1A would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.5 wetted acre of vernal pool (or 3 acres of vernal pool complex using the 15% density) should be restored and 3.4 acres protected (or 23 acres of vernal pool complex) protected to mitigate the CM1 indirect effects on vernal pool habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1A-16, impacts on wetted vernal pools resulting from tidal restoration in the near-term could not exceed 4.5 wetted acres direct and 8.8 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration will be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrate habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1A-16, the effects of CM1 alone would be well within the near-term limits but overall Alternative 1A would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).

NEPA Effects: The near-term loss of nonlisted vernal pool species habitat under Alternative 1A would not be adverse because the BDCP has committed to avoiding and minimizing effects resulting from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the modification of vernal pool habitat and potential mortality of special-status species resulting from Alternative 1A in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management and enhancement would be guided by goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, losses and conversion of nonlisted vernal pool species habitat and potential mortality under Alternative 1A would not be adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1A-15 above lists the impacts on vernal pool habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools. As seen in Table 12-1A-16, the effects of CM1 alone would be well within the near-term limits. The BDCP states that covered activities would not result in more than 5 wetted acres of direct loss and no more than 10 wetted acres of indirect effects on vernal pools in the near-term. As seen in Table 12-1A-16, Alternative 1A would not meet the

Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.5 wetted acre of vernal pool (or 3 acres of vernal pool complex using the 15% density) should be restored and 3.4 acres (or 23 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on nonlisted vernal pool invertebrate habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1A-16, impacts on wetted vernal pools resulting from tidal restoration in the near-term could not exceed 4.5 wetted acres direct and 8.8 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration will be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrates.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of the BDCP affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1A-16, the effects of CM1 alone would be well within the near-term limits but overall Alternative 1A would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

In the absence of other conservation actions, the effects on nonlisted vernal pool invertebrate habitat from Alternative 1A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, the BDCP has committed to impact limits for vernal pool habitat and to the habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, Alternative 1A over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 1A would have a less-than-significant impact on nonlisted vernal pool invertebrates.

Impact BIO-39: Indirect Effects of Plan Implementation on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6 and AMM10, which would be in effect throughout the Plan's construction phase.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Nonlisted vernal pool invertebrates and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebays could result in the inadvertent discharge of sediments and hazardous materials into vernal pool habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of Alternative 1A implementation would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase. Therefore, the indirect effects of Alternative 1A would have a less-than-significant impact on vernal pool invertebrates.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled habitat for nonlisted vernal pool invertebrates (Table 12-1A-15). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration.*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect nonlisted vernal pool invertebrates occupying areas ranging from 0 acres of habitat during most notch flows, to an estimated 4 acres during a notch flow of 6,000 cubic feet per second. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus not be adverse under NEPA.

CEQA Conclusion: Alternative 1A would periodically inundate a maximum of 4 acres of nonlisted vernal pool invertebrates' habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of nonlisted vernal pool invertebrates' habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus result in less-than-significant impacts on the species.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes the inland dune scrub habitat at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c, 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 1A would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance facilities construction would not affect inland dune scrub habitat at Antioch Dunes NWR. No dredge spoil areas that could potentially be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 1A water intake facilities on aerial imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of BDCP restoration based conservation measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the Plan Area is at Antioch Dunes, which would not be impacted by the Alternative 1A conservation measures. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of BDCP restoration actions, and other covered activities could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the Plan Area; however the extent of these habitats in the Plan Area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Over the term of the BDCP, Alternative 1A would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 1A objectives would generally increase opportunities for the formation of sandbars in the Plan Area.

- Restore 10,000 acres of seasonally inundated floodplain (Objective L2.11, associated with CM5).
- Enhance 20 miles of channel margin habitat (Objective L2.12, associated with CM6).
- Restore 5,000 acres of riparian habitat, with at least 3,000 acres occurring on restored seasonally inundated floodplain. (VFRNC1.1, associated with CM7).

These measures will improve shoreline conditions by creating benches along levees, shallow habitat along margins and in floodplains, and increasing shoreline vegetation, all of which will likely contribute to the formation of sandbars along Delta river channels where these measures will be implemented. Increasing the structural diversity of Delta river channel margins and floodplains will create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-17. Changes in Sacramento and Antioch Dunes Anthicid Beetle Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 1A conservation measures could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur along to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of Google Earth imagery of the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of aerial photographs in the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Conservation measures that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal natural communities restoration (CM4), seasonally inundated floodplain restoration (CM5), and channel margin enhancement (CM6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The West Delta ROA has been identified in the BDCP (BDCP Chapter 3, *Conservation Strategy*, Section 3.4.4) as providing opportunities for creating subtidal aquatic and tidal marsh habitats. The methods and techniques identified in BDCP Chapter 3, Section 3.4.4.3.3 that may be used for tidal restoration include the recontouring of lands so that they have elevations suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.
- *CM5 Seasonally Inundated Floodplain Restoration*: Seasonally inundated floodplain restoration could impact areas with sandbars that were identified in a review of aerial photographs. The sandbars identified along the San Joaquin River and Paradise Cut are within the conceptual corridors (Corridors 1a, 1b, 2a, and 4) identified in Figure 3.4-20 of the BDCP. There are four CNDDB records for Sacramento anthicid beetle in the conceptual corridor along the San Joaquin River (California Department of Fish and Wildlife 2013). Floodplain restoration actions in these conceptual corridors could impact potential habitat for both these species and occupied habitat of Sacramento anthicid beetle.
- *CM6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 20 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The BDCP could result in substantial affects to Sacramento and Antioch Dunes anthicid beetle because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which is being considered for tidal restoration (CM4), or within three of the conceptual corridors being considered for floodplain restoration (CM5). Furthermore, all seven of the records for Sacramento anthicid beetle within the study area fall within areas being considered for restoration (CM4 and CM5), which represent over half of the extant records for this species range wide (7 of 13), and the only extant record for Antioch Dunes anthicid beetle, which represent one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected by restoration if these areas are choses as restoration projects. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. Under Alternative 1A, CM5, CM6, and CM7 would generally contribute to the formation of sandbar habitat in the Plan Area. These measures would improve shoreline conditions by creating benches along levees (CM6), creating shallow margin and floodplain habitat (CM5), and increasing shoreline vegetation (CM7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form. There are three other factors relevant to effects on Sacramento and Antioch Dunes anthicid beetle.

- The actual extent of suitable and occupied habitat for these species in the plan is unknown.
- The sandbar habitat occupied by Sacramento anthicid beetle along the San Joaquin River would likely not be directly impacted where floodplain restoration occurs because the physical disturbance would be to adjacent levees and agricultural areas. Though these actions would change hydrologic conditions that could overtime remove the existing sandbars, the expanded floodplain would create conditions suitable for the formation of new and possibly larger sandbars.
- Floodplain restoration would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

NEPA Effects: The potential impacts on Sacramento and Antioch Dunes anthicid beetle associated with Alternative 1A as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with implementation of restoration associated with CM5, CM6, and CM7, which would be phased throughout the time period when the impacts would be occurring, the effects of Alternative 1A as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion: Alternative 1A would impact Sacramento and Antioch Dunes anthicid beetles' habitat and could impact seven occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. BDCP conservation components, particularly CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. Floodplain restoration (CM5) would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented, new sandbar habitat will likely be forming prior to or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River or Paradise Cut.

Considering that floodplain restoration (CM5), channel margin enhancement (CM6), and riparian habitat restoration (CM7) would contribute to the replacement of and possible expansion of sandbar habitat in the Delta and would be phased throughout the time period when the impacts would be occurring, the implementation of Alternative 1A as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than significant impact on Sacramento and Antioch Dunes anthicid beetle.

Delta Green Ground Beetle

This section describes the effects of Alternative 1A on delta green ground beetle. Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1A would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 1A could affect delta green ground beetle through the protection of grasslands and vernal pool complex (CM3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions and recreational trail construction (CM11) in these areas. In addition, tidal natural communities restoration (CM4) and vernal pool and alkali seasonal wetland complex restoration (CM9) could result in potential impacts on delta green ground beetle and its habitat. Full implementation of Alternative 1A would likely result in beneficial effects on delta green ground beetle through the following conservation actions.

- Protect 2,000 acres of grassland in CZ 1 (Objective GNC1.1, associated with CM3).
- Protect 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1, associated with CM3).
- Restore up to 67 acres of vernal pool complex in CZs 1, 8, and/or 11 (Objective VPNC1.2, associated with CM9).

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1A-18. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 1A conservation measures could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Conservation measures that could affect delta green ground beetle include tidal natural communities habitat restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and habitat enhancement and management activities (CM11) in CZ 1. CZ 1 is the only portion of the Plan Area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; U.S. Fish and Wildlife Service 2009a). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *CM4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. CM4 identifies 5,000 acres of freshwater tidal natural communities restoration in the Cache Slough ROA and Lindsey Slough and Calhoun Cut have been identified as areas suitable for restoration. Lindsey Slough is just east of Jepson Prairie, and Calhoun Cut, which is off of Lindsey Slough (see Figure 12-1), goes into the general Jepson Prairie area and is adjacent to areas of potential habitat for delta green ground beetle. The tidal restoration methods and techniques identified in CM4 include excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affects delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species. No CNDDB records for delta green ground beetle are intersected by the hypothetical tidal restoration footprints being used by the BDCP.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle but if these activities do take place in areas more suitable then disturbances could result in direct mortality to the species but ultimately would expand habitat available to the species.

- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 1 and a portion of the 600 acres of protection and possibly some of the up to 10 wetted acres of vernal pool restoration could also occur in CZ 1. Potential effects from CM11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of CM11 will result in impacts on 15.5 acres of grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The protection of 2,000 acres of grassland in CZ 1 (CM3) and the protection of 600 acres of vernal pool complex and up 10 wetted acres of vernal pool complex restoration, some of which could occur in CZ 1 (CM3 and CM9), could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. The management of these grasslands and vernal pool complexes according to *CM11 Natural Communities Enhancement and Management* and the construction of recreational trails in CZ 1 have a potential to affect this species. AMM37 would ensure that new trails in vernal pool complexes would be sited at least 250 feet from wetland features, or closer if site specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Direct mortality or the effects on delta green ground beetle habitat would be an adverse effect under Alternative 1A. Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would be available to address this effect.

CEQA Conclusion: The implementation of grassland protection (CM3), tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from CM11 could include direct mortality of larvae and adults resulting from the implementation of recreation trail construction in 15.5 acres of grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes are sited at least 250 feet from wetland features, or closer if site specific information indicates that local watershed surrounding a vernal pools is not adversely affected. CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and, therefore, would result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areas in the area of Jepson Prairie, BDCP proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.

- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing covered activities in these areas will be avoided, which for the Plan Area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing activities will occur in areas identified as occupied by delta green ground beetle.
- Based on the results of the habitat evaluations and surveys, site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

Suitable habitats for callippe silverspot butterfly are typically in areas influenced by coastal fog with hilltops that support the specie's host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldenaster, coast buckwheat, mourning bride, and California buckeye. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1A would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *CM3 Natural Communities Protection and Restoration* and the subsequent implementation of *CM11 Natural Communities Enhancement and Management,* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the Plan Area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005; California Department of Fish and Wildlife 2013). Though has been identified as potential area for grassland restoration in *CM8 Grassland Natural Community Restoration,* the primary goal there is to restore small patches of grassland to connect to Jepson Prairie and/or the restoration of upland grasses adjacent to tidal brackish emergent wetland in Suisun Marsh, both of which would not be areas suitable for callippe silverspot butterfly. The full implementation of Alternative 1A would protect up to 2,000 acres of grassland in CZ 11 (Objective GNC1.1, associated with CM3), some of which may contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1A-19. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 1A (acres)[a]

Conservation Measureb	Permanent		Temporary		Periodicd	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	0	0	0	0	NA	NA
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 1A conservation measures could result in the conversion of habitat and/or direct mortality to callippe silverspot butterfly. Only one conservation measure was identified as potentially affecting callippe silverspot butterfly, *CM11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *CM3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 11 under CM11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects resulting from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of 2,000 acres of grassland within could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. The management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has potential to adversely affect this species. Direct mortality or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would be available to address this effect.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *CM3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has the potential to affect this species. Potential impacts from CM11 could include the loss of larval host and nectar sources and direct mortality of larvae and adults resulting from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control that may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, which could result in direct and indirect effects on larval host plants and nectar plants. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would, therefore, result in significant impact on the species. However, over the term of BDCP, callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species. In addition, the implementation of Mitigation Measure BIO-43 would reduce the potential impact of habitat loss or conversion on callippe silverspot butterfly to a less-than-significant level.

Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, BDCP proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.

- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-1A-20. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP to benefit the California red-legged frog (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11, CM13, and CM20).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3)
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-20. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	1	1	0	0	NA	NA
	Upland	5	5	153	153	NA	NA
Total Impacts CM1		**6**	**6**	**153**	**153**		
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	8	24	0	0	0	0
Total Impacts CM2–CM18		**8**	**24**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**14**	**30**	**153**	**153**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 1A conservation measures would result in the permanent and temporary loss combined of up to 1 acre of modeled aquatic habitat and 182 acres of modeled upland habitat for California red-legged frog (Table 12-1A-20). There are no California red-legged frog occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction (CM1) and recreational facility construction for CM11. Construction activities associated with the water conveyance facilities and recreational facilities, including operation of construction equipment, could result in temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California red-legged frog habitat and could result in injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A, including transmission line construction, would result in the permanent loss of up to 1 acre of aquatic habitat and 5 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-1A-20). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 153 acres of upland habitat for the California red-legged frog (Table 12-1A-20). Surveys have not found any evidence that the species is using this habitat (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

- *CM11 Natural Communities Enhancement and Management*: An estimated 24 acres of upland cover and dispersal habitat for the California red-legged frog would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation-related effects on California red-legged frog are expected to be minimal.

  In addition, activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs listed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog.

- Critical habitat: Several conservation measures would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Conservation actions to protect and enhance grassland habitat for covered species, including California red-legged frog, in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation conservation actions and AMM1–AMM6, AMM10, AMM14, and AMM37, would reduce these effects.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of conveyance facilities construction would not be adverse under NEPA.

Alternative 1A would permanently remove approximately 1 acre of aquatic habitat and 166 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 158 acres) and recreational facilities (CM11, 8 acres).

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California red-legged frog in BDCP Chapter 3 would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 332 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat, which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical

mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM14 California Red-Legged Frog, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic and 7,766 acres of upland habitat for California red-legged frog. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 182 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 1% of the total upland habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

NEPA Effects: In the near-term, the loss of California red-legged frog habitat under Alternative 1A would be not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1A, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 1A as a whole on California red-legged frog would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impact of conveyance facilities construction would be less than significant.

Alternative 1A would permanently remove approximately 1 acre of aquatic habitat and 166 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 158 acres) and recreational facilities (CM11, 8 acres).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 332 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM14, and AMM37. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A on California red-legged frog would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 1 acre of aquatic habitat restored, 1 acre of aquatic habitat protected, and 332 acres of upland communities protected.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic 7,766 acres of upland habitat for California red-legged frog. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 182 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 1% of the total upland habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

In the absence of other conservation actions, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and AMM1–6, AMM10, AMM14, and AMM37, the effects of Alternative 1A would have a less-than-significant impact on California red-legged frog.

Impact BIO-45: Indirect Effects of Plan Implementation on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas that would be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted in this area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1-AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 1A would avoid the potential for adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on California red-legged frog.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance, as well as construction-related noise and visual disturbances including aritifical nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, construction, operation, and maintenance under Alternative 1A would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 1A would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

Alternative 1A is expected to result in the temporary and permanent removal of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-1A-21). Potential aquatic habitat for this species would not be affected. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP to benefit the California tiger salamander (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

- Increase the size and connectivity of protected vernal pool complex within the Plan Area and increase connectivity with protected vernal pool complex adjacent to the Plan Area (Objective VPNC1.3, associated with CM3).
- Protect the range of inundation characteristics that are currently represented by vernal pools throughout the Plan Area (Objective VPNC1.4, associated with CM3).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-21. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	0	0	0	0	NA	NA
	Upland	5	5	158	158	NA	NA
Total Impacts CM1		**5**	**5**	**158**	**158**		
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	292	634	0	0	191–639	0
Total Impacts CM2–CM18		**292**	**634**	**0**	**0**	**191-639**	**0**
TOTAL IMPACTS		**297**	**639**	**158**	**158**	**191–639**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 1A conservation measures would result in the permanent and temporary loss combined of up to 797 acres of modeled upland habitat for California tiger salamander (Table 12-1A-21). There are no California tiger salamander occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal natural communities restoration (CM4), construction of recreational facilities (CM11), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California tiger salamander habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities, including transmission lines, would result in the permanent loss of 5 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-1A-21). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 158 acres of upland habitat for the California tiger salamander (Table 12-1A-21). The area that would be affected by conveyance facilities construction is south of Clifton Court Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and are west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent removal of approximately 42 acres of terrestrial cover and aestivation habitat for the California tiger salamander in the late-longterm. The modeled habitat in the Yolo Bypass is of low potential for California tiger salamander: There have been no observations of California tiger salamander in this area based on the results of a number of surveys for vernal pool invertebrates and plants and the bypass lacks vernal pool complexes with large, deep pools or large grassland areas with stock ponds and similar aquatic features that hold water long enough to provide potential breeding habitat for this species.

- *CM4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of approximately 517 acres of terrestrial cover and aestivation habitat in the study area in the late longterm. Tidal restoration in the Cache Slough area would result in habitat loss along the edges of Lindsey Slough and Duck Slough, and adjacent to cultivated land along the eastern edge of a block of modeled habitat. The modeled aquatic breeding habitat nearby the hypothetical tidal restoration footprint is of relatively high value, consisting of vernal pool complex along Lindsey Slough within the Jepson Prairie area in and near open space. The Jepson Prairie area includes numerous California tiger salamander CNDDB recorded occurrences and overlaps with Critical Habitat Unit 2, Jepson Prairie Unit, for this species, however, the hypothetical tidal restoration footprint does not overlap with critical habitat or recorded occurrences in this area. The tidal restoration at Lindsey Slough along the northeastern edge of the Jepson Prairie block of habitat and would not contribute to fragmentation. Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because of the ability to select sites that minimize effects on California tiger salamander.

- *CM11 Natural Communities Enhancement and Management*: An estimated 40 acres of terrestrial cover and aestivation habitat for the California tiger salamander would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation-related effects on California tiger salamander are expected to be minimal.

  Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values over the term of the BDCP. At least 1,000 acres of grassland habitat and some unknown acres of vernal pool complex habitat in CZ 8 are expected to benefit the California tiger salamander through protection of existing upland cover and dispersal habitat from potential loss or degradation that otherwise could happen with future changes in existing land use.

  Activities associated with natural communities enhancement and management over the term of the BDCP in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- *CM18 Conservation Hatcheries*: This activity could result in the permanent removal of approximately 35 acres of terrestrial cover and aestivation habitat for California tiger salamander in the Yolo Bypass area (CZ 2). The specifications and operations of this facility have not been developed, although the facility is expected to be constructed near Rio Vista on cultivated lands in low-value habitat for the species.

- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions. Tidal habitat would be restored approximately 2 miles east of SR 113, with some restoration taking place along the Barker and Lindsey Slough channels west to approximately SR 113 and a small amount (0.4 acre) taking place along the Lindsey Slough Channel west of SR 113 into Critical Habitat Unit 2.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1A would permanently remove approximately 455 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 163 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), recreational facilities (CM11, 12 acres) and construction of conservation hatcheries (CM18, 35 acres).

Typical NEPA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 910 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 910 acres of upland communities protected.

In addition, the plan contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland habitat for California tiger salamander. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 797 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

NEPA Effects: In the near-term, the loss of California tiger salamander habitat under Alternative 1A would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California tiger salamander upland habitat associated with Alternative 1A, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, the effects of Alternative 1A as a whole on California tiger salamander would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant.

Alternative 1A would permanently remove approximately 455 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 163 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), recreational facilities (CM11, 12 acres) and construction of conservation hatcheries (CM18, 35 acres).

Typical CEQA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 910 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes.

In addition, the plan contains commitments to implement AMM1–6, AMM10, AMM13, and AMM37 which include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1A on California tiger salamander would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 910 acres of upland communities protected.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland habitat for California tiger salamander. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 797 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

In the absence of other conservation actions, the losses of California tiger salamander upland habitat associated with Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction phase, the impacts of Alternative 1A as a whole on California tiger salamander would not be significant under CEQA.

Impact BIO-47: Indirect Effects of Plan Implementation on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conservation component construction and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical night lighting at a worksite, over the term of the BDCP. Most of the areas indirectly affected are associated with the construction of Byron Forebay and its borrow and spoil areas in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 1A would avoid or minimize the potential for substantial adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances, including aritifical night lighting at a worksite, could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 1A, the BDCP would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 1A would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement is the only conservation measure expected to result in periodic inundation of California tiger salamander habitat. Periodic inundation could affect from an estimated 191 acres of terrestrial habitat during a notch flow of 1,000 cfs, to an estimated 639 acres of terrestrial habitat during a notch flow of 4,000 cfs in CZ 1 (Table 12-1A-21). This effect would only occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal terrestrial habitat for the California tiger salamander under existing conditions. No aquatic breeding habitat would be affected (Table 12-1A-21): the modeled habitat in the Yolo Bypass, in the vicinity of terrestrial habitat is of low value in that there are no California tiger salamander records in this area and the bypass lacks vernal pool complexes with large, deep pools, or large grassland areas with stock ponds and similar aquatic features that provide the habitat of highest value for this species. Therefore, the terrestrial habitat to be affected has a small likelihood of supporting California tiger salamanders, and Yolo Bypass operations are expected to have a minimal effect on the species, if any.

NEPA Effects: The effects of periodic inundation from Alternative 1A would not have an adverse effect on California tiger salamander.

***CEQA Conclusion*:** Flooding of the Yolo Bypass from Fremont Weir operations would periodically increase the frequency and duration of inundation of 191–639 acres of terrestrial habitat for California tiger salamander. Because this area is considered low-value habitat and there are no California tiger salamander records in the area, and because of the lack of suitable breeding habitat in this area, the effects of periodic inundation of California tiger salamander habitat from Alternative 1A would have a less-than-significant impact**.**

Giant Garter Snake

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on the giant garter snake. The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic (except in Suisun Marsh), tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities within 200 feet of modeled aquatic habitat features (primarily grassland and cropland). The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-1A-22. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP to benefit the giant garter snake (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2,CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3 and CM11).

- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Of the at least 1,200 acres of nontidal marsh created under (Objective NFEW/NPANC1.1), create 600 acres of aquatic habitat giant garter snake aquatic habitat that is connected to the 1,500 acres of rice land or equivalent-value habitat described below in Objective GGS1.4 (Objective GGS1.1, associated with CM3, CM4, and CM10).
- Of the 8,000 acres of grassland protected under Objective GNC1.1 and 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of nontidal perennial habitat being restored and/or created in CZ 4 and/or CZ 5 (Objective GGS1.2, associated with CM3 and CM8).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands (Objectives GGS1.1 and GGS1.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS1.3, associated with CM3).
- Create connections from the White Slough population to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 1,500 acres may consist of tidal freshwater emergent wetland and may overlap with the 24,000 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria described in CM4. Up to 500 (33%) of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS1.4, associated with CM3 and CM4).
- Of the at least 1,200 acres of nontidal marsh created under Objective NFEW/NPANC1.1, create 600 acres of connected aquatic giant garter snake habitat outside the Yolo Bypass in CZ 2 (Objective GGS2.1, associated with CM3 and CM10).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland habitat adjacent to the 600 acres of nontidal marsh created in CZ 2 outside of Yolo Bypass (GGS2.1) (Objective GGS2.2, associated with CM3 and CM8).
- To expand upon and buffer the newly restored/created nontidal perennial habitat in CZ 2, protect 700 acres of cultivated lands, with 500 acres consisting of rice land and the remainder consisting of compatible cultivated land that can support giant garter snakes. The cultivated lands may be a subset of lands protected for the cultivated lands natural community and other covered species (Objective GGS2.3, associated with CM3).
- Protect giant garter snakes on created nontidal marsh (Objective GGS2.1) and created or protected adjacent uplands (Objective GGS2.2) from incidental injury or mortality by

establishing 200-foot buffers between protected giant garter snake habitat and roads, and establishing giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS2.4, associated with CM3).

- Protect, restore, and/or create 2,740 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 1, CZ 2, CZ 4, or CZ 5. Up to 500 acres may consist of tidal freshwater emergent wetland and may overlap with the at least 5,000 acres of tidally restored freshwater emergent wetland in the Cache Slough ROA if this portion meets giant garter snake habitat criteria specified in CM4. Up to 1,700 acres may consist of rice fields in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*. Any remaining acreage will consist of rice land or equivalent-value habitat outside the Yolo Bypass. Up to 915 (33%) of the 2,740 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS3.1, associated with CM3, CM4, and CM10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-22. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 1A[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Aquatic (acres)	52	52	36	36	NA	NA
	Upland (acres)	392	392	182	182	NA	NA
	Aquatic (miles)	18	18	8	8	NA	NA
Total Impacts CM1 (acres)		**444**	**444**	**218**	**218**		
CM2–CM18	Aquatic (acres)	179	498	15	38	NA	69
	Upland (acres)	1,467	2,443	219	261	582–1,402	606
	Aquatic (miles)	49	189	9	10	0	NA
Total Impacts CM2–CM18 (acres)		**1,646**	**2,941**	**234**	**299**	**582–1,402**	**675**
TOTAL IMPACTS CM1–CM18 (acres)		**2,090**	**3,385**	**452**	**517**	**582-1,402**	**675**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.
[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts on upland habitats only are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 1A conservation measures would result in the permanent and temporary loss combined of up to 624 acres of modeled aquatic habitat (tidal and nontidal combined), up to 3,278 acres of modeled upland habitat, and up to 225 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-1A-22). There is one giant garter snake occurrence that overlaps with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of approximately 444 acres of modeled giant garter snake habitat, composed of 52 acres of aquatic habitat and 392 acres of upland habitat (Table 12-1A-22). The 392 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 73 acres of high-, 292 acres of moderate-, and 27 acres of low-value habitat. In addition, approximately 18 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 36 acres of giant garter snake aquatic habitat and up to 162 acres of adjacent upland habitat in areas near construction in CZ 5 and CZ 6 (see Table 12-1A-22 and Terrestrial Biology Map Book). In addition, approximately 8 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction. Most of the habitat to be lost is in CZ 6 on Mandeville Island. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Water facilities construction and operation is expected to have low to moderate potential for adverse effects on giant garter snake aquatic habitat on Mandeville Island because it is not located near or between populations identified in the draft recovery plan.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 83 acres of aquatic habitat and 458 acres of upland habitat for the giant garter snake in the late long-term. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Most of this habitat removal would occur at the north end of the Yolo Bypass, near Fremont Weir. Construction is expected to have adverse effects on giant garter snake aquatic habitat in the Yolo Bypass area because it is near the Yolo Basin/Willow Slough population. The upland habitat that would be removed is composed of 336 acres of high-value, 121 acres of moderate-value, and 1 acre of low-value habitat.

  In addition to habitat loss from construction related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5J, Attachment

5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 395 acres of aquatic habitat and 2,123 acres of upland habitat for the giant garter snake to tidal marsh in the late long-term. The upland habitat affected by tidal inundation includes 594 acres of high-value, 1,375 acres of moderate-value, and 154 acres of low-value habitat. In addition, approximately 138 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration.

  Most of the effects of tidal natural communities restoration would occur in the Cache Slough and Yolo Bypass areas (CZ 1 and CZ 2). This aquatic habitat is of low to moderate value: it is in and near Category 1 open space but is not near any giant garter snake occurrences and is not near or between giant garter snake subpopulations identified in the draft recovery plan. Tidal natural communities restoration is expected to have little to no adverse effects on giant garter snake aquatic or upland habitat in the Cache Slough ROA. There are no giant garter snake occurrences in this area, which is already tidally influenced so it has limited value for the giant garter snake (giant garter snakes may occur in tidally muted areas but are not likely to use aquatic areas with a strong tidal influence).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 89 acres of upland habitat for giant garter snake. The upland habitat to be removed is composed of 51 acres of moderate-value and 38 acres of low-value upland habitat. Approximately 2 miles of channels providing giant garter snake movement habitat would be removed as a result of floodplain restoration. Seasonally inundated floodplain restoration is expected to have little to no adverse effects on giant garter snake aquatic habitat because the site is not located near or between giant garter snake populations identified in the draft recovery plan. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on giant garter snake habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the applicable AMMs.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, *AMM37 Recreation*, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, requires setbacks for trails in giant garter snake habitat. With this measure in place, recreation related effects on giant garter snake are expected to be minimal.

- *CM18 Conservation Hatcheries*: Construction for conservation hatcheries could result in the permanent removal of 35 acres of moderate-value upland habitat for the giant garter snake in the Yolo Bypass area (CZ 2).
- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below. Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the two subpopulations: Yolo Basin/Willow Slough [CZ 2] and the Coldani Marsh/White Slough [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction, as described in *AMM16 Giant Garter Snake.*

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1A would permanently and temporarily remove 282 acres of aquatic habitat and 2,260 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 88 acres of aquatic and 574 acres of upland habitat), from Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and from Conservation Hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 84 miles of channels (irrigation and drainage canals) providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 282 acres of aquatic habitat should be restored, 282 acres of aquatic habitat should be protected, and 4,520 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value) in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 282 acres of aquatic communities restored and 4,520 acres of upland communities protected.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM16 Giant Garter Snake, and AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 624 acres of aquatic habitat and to 3,278 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat in the study area and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value) in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake under Objective GGS3.1 to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

NEPA Effects: In the near-term, the loss of giant garter snake habitat under Alternative 1A would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of giant garter snake associated with Alternative 1A, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM7, AMM10, AMM16, and AMM37, the effects of Alternative 1A as a whole on giant garter snake would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 1A would permanently and temporarily remove 282 acres of aquatic habitat and 2,260 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 88 acres of aquatic and 574 acres of upland habitat), from Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and from Conservation Hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 84 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 282 acres of aquatic habitat should be restored, 282 acres of aquatic habitat should be protected, and 4,520 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value) in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 282 acres of aquatic communities restored, 282 acres of aquatic communities protected, and 4,520 acres of upland communities protected.

The Plan also includes commitments to implement AMM1-AMM7, AMM10, AMM16, and AMM37. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 624 acres of aquatic habitat and to 3,278 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat in the study area and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value) in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under

Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake under Objective GGS3.1 to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat. The BDCP also includes AMM1–AMM7, AMM10, AMM16, and AMM37, all of which are directed at minimizing or avoiding potential impacts on adjacent habitats during construction and operation of the conservation measures.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the giant garter snake. Therefore, the loss of giant garter snake habitat and potential mortality of snakes would have a less-than-significant impact on giant garter snake under CEQA.

Impact BIO-50: Indirect Effects of Plan Implementation on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and 37, which would be in effect throughout the plan's construction phase.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1-AMM6 would minimize the likelihood of such spills occurring and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under CM1 were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and floodplains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp, and mosquitofish. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with avoidance and minimization measures and adaptive management and monitoring, *CM12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities and floodplains.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the Central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Effects on giant garter snake from increased methylmercury exposures is more likely in the Yolo Basin, where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008). Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). Planned floodplain restoration activities in the Yolo Basin are expected to seasonally increase methylmercury production, although production would be minimized by *CM12 Methylmercury Mitigation*, Further, the periods of production and increased exposure to methylmercury do not overlap with giant garter snake seasonal activity periods. This seasonal trend should help to decrease risk to the giant garter snake, although snakes could prey on individuals that have been exposed to methylmercury during the previous season.

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and will need to be assessed at the project level. Measures described in *CM12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 is expected to reduce the effects of methylmercury resulting from BDCP natural communities and floodplain restoration on giant garter snake.

***NEPA Effects*:** Implementation of the AMMs listed above as part of implementing Alternative 1A would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on giant garter snake.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and 37 as part of Alternative 1A construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Alternative 1A would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the indirect effects of Alternative 1A would have a less-than-significant impact on giant garter snakes.

Giant garter snake could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes, and, therefore, would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 1A would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Deltain the study area.

***NEPA Effects*:** Alternative 1A would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***CEQA Conclusion*:** Alternative 1A would have a less-than-significant impact on connectivity between giant garter snakes in the study area.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement: The proposed changes in Fremont Weir operations will occur intermittently from as early as mid-November through as late as mid-May. The core operations will occur during the winter/spring period, which corresponds mostly with the giant garter snake's inactive season. During this time, snakes are overwintering underground. Giant garter snakes that occur in the bypass during the active season could potentially overwinter in the bypass during the inactive season: these snakes may be vulnerable to inundation of the bypass and could be drowned or displaced from overwintering sites. However, most typically, Fremont Weir "notch" operations will occur on the shoulders of time periods in which the Sacramento River rises enough for Fremont Weir to overtop passively, without the proposed project. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Duration of inundation may also be an important factor determining effects on overwintering giant garter snakes. Radiotelemetry studies have revealed giant garter snakes surviving in burrows that had been inundated for 2 to 3 weeks, but it is unknown what duration of inundation the snakes can survive while overwintering in their burrows.

Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants,* provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect giant garter snakes overwintering in upland areas ranging from an estimated 582 acres of upland habitat during notch flow of 1,000 cfs to an estimated 1,402 acres during a 4,000-cfs notch flow. The 4,000-cfs notch flow would affect an estimated 888 acres of high value habitat and 514 acres of moderate value habitat.

As noted above under the discussion of habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of a maximum of 1,662 acres of rice fields (BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass*). This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term. Restoration and protection of 2,740 acres of rice land or habitat of equivalent value for the giant garter snake would achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass) as a result of CM2.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 606 acres of upland habitat for the giant garter snake in the south Delta (CZ 7). The upland habitat to be inundated contains 432 acres of moderate-value and 174 acres of low-value habitat. The area between existing levees would be breached and the newly constructed setback levees will be inundated through seasonal flooding. The restored floodplain will include a range of elevations from low-lying areas that flood frequently (e.g., every 1 to 2 years) to high-elevation areas that flood infrequently (e.g., every 10 years or more). There are no records of giant garter snakes in the vicinity of where floodplain restoration is expected to occur.

Based on modeled habitat for the giant garter snake, the study area supports approximately 53,285 acres of upland habitat for giant garter snake. Approximately 2,008 acres of giant garter snake upland habitat (4% of total upland habitat in the study area) may be adversely affected by periodic flooding as a consequence of floodplain restoration and the operation of the Fremont Weir.

NEPA Effects: Periodic effects on upland habitat for giant garter snake associated with implementing Alternative 1A are not expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, Alternative 1A would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect a total of approximately 2,008 acres of upland habitat for giant garter snake. The inundation could affect overwintering snakes. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Therefore, increased inundation in the Yolo Bypass as a result of BDCP is expected to have a minimal effect on the Yolo Basin/Willow Slough population. Implementing Alternative 1A, including AMM1–AMM7, AMM10, and AMM16, would not be expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Periodic inundation under Alternative 1A would have a less-than-significant impact on the species.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, Section 2A.30, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-1A-23. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP to benefit the western pond turtle (BDCP Chapter 3, *Conservation Strategy*).

- Protect or restore 142,200 acres of high-value natural communities and covered species habitats (Objective L1.1, associated with CM3).
- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise. Minimum restoration targets for tidal natural communities in each ROA are 7,000 acres in Suisun Marsh ROA, 5,000 acres in Cache Slough ROA, 1,500 acres in Cosumnes/Mokelumne ROA, 2,100 acres in West Delta ROA, and 5,000 acres in South Delta ROA (Objective L1.3, associated with CM2, CM3, and CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands (Objective L1.3), include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM3, CM4, and CM8).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Allow lateral river channel migration (Objective L2.2, associated with CM3 and CM5).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect and enhance 8,100 acres of managed wetland, 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3 and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-23. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 1A[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic (acres)	49	49	79	79	NA	NA
	Upland[e] (acres)	161	161	58	58	NA	NA
	Aquatic (miles)	11	11	5	5		
Total Impacts CM1 (acres)		**210**	**210**	**137**	**137**		
CM2–CM18	Aquatic (acres)	82	114	23	44	NA	NA
	Upland (acres)	414	1,028	119	136	283-798	331
	Aquatic (miles)	25	109	3	4		
Total Impacts CM2–CM18 (acres)		**496**	**1,142**	**142**	**180**	**283–798**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**706**	**1,352**	**279**	**317**		**479**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

[e] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 1A conservation measures would result in the permanent and temporary loss of up to 286 acres of aquatic habitat and 1,383 acres of upland nesting and overwintering habitat (Table 12-1A-23). There are 6 western pond turtle occurrences that overlap with the CM1 footprint and a number of additional occurrences in the vicinity (Figure 12-16). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4) and seasonally inundated floodplain restoration (CM5), and riparian restoration (CM7). Habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western pond turtle habitat. The activity accounting for most (80%) of the habitat loss or conversion would be *CM4 Tidal Natural Communities Restoration*. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of approximately 49 acres of aquatic habitat and 161 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-1A-23). Development of the water conveyance facilities would also result in the temporary removal of up to 79 acres of aquatic habitat and 58 acres of nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-1A-23). Approximately 11 miles of channels providing western pond turtle movement habitat would be removed as a result of floodplain restoration and 5 miles would be temporarily disturbed. There are six western pond turtle occurrences that overlap with the CM1 footprint in CZ 2 around Clifton Court Forebay and in CZ 5 scattered throughout the Delta. The majority of the permanent loss of aquatic habitat and nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high-value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering and dispersal habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. While there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the pipeline footprint.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 249 acres of upland nesting and overwintering habitat for the western pond turtle. Approximately 4 miles of channels providing western pond turtle movement habitat would be permanently or temporarily removed as a result of Yolo Bypass improvements. Although there are no CNDDB occurrences for western pond turtle in the Yolo Bypass, the species is known to be present in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2013).

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of approximately 45 acres of aquatic habitat and 872 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Approximately 106 miles of channels providing western pond turtle movement habitat would be removed as a result of restoration. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration outside Suisun Marsh is likely to create suitable, slow-moving freshwater slough and marsh habitat.

  Although the aquatic habitat model includes all tidal perennial aquatic, tidal brackish emergent wetland, and managed wetland as habitat most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not hydrologically connected to Suisun Marsh (Patterson pers. comm.). While the model does not include an aquatic class type called *drainage ditches* and therefore an effect on this habitat type cannot be calculated, it is likely that this general type of habitat accounts for a very small portion of the total modeled aquatic effects; almost certainly less than 5%, or less than 287 acres of the modeled aquatic habitat affected by tidal restoration. The suitable nesting and overwintering habitat that would be affected in the interior of Suisun Marsh is limited, because the levees likely function as the primary nesting and overwintering habitat. The nesting and overwintering habitat of highest value to be affected is on the fringe of the marsh where the aquatic habitat is adjacent to undeveloped grassland habitat.

The habitat affected in the interior Delta (West Delta and South Delta) is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle. Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 53 acres of aquatic habitat 33 acres of upland habitat for western pond turtle. Approximately 3 miles of channels providing western pond turtle movement habitat would be removed or temporarily disturbed as a result of floodplain restoration. Although there are no CNDDB occurrences of the western pond turtle in the areas where floodplain restoration is likely to occur, the species is known to occur along the San Joaquin River to the south in the San Joaquin River National Wildlife Refuge. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration that is part of tidal natural communities restoration in CZ 1 and CZ 2, would result in the permanent removal of 10 acres of upland nesting and overwintering habitat for western pond turtle.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values over the term of the BDCP. In addition, effects would be avoided and minimized by the AMMs listed below.

  Management of the 6,600 acres of managed wetlands to be protected for waterfowl and shorebirds is not expected to result in overall adverse effects for the western pond turtle. Management actions that would improve wetland quality and diversity on managed wetlands include control and eradication of invasive plants; maintenance of a diversity of vegetation types and elevations, including upland areas to provide flood refugia; water management and leaching to reduce salinity; and enhancement of water management infrastructure (improvements to enhance drainage capacity, levee maintenance). These management actions could potentially benefit the western pond turtle. The 6,600 acres of protected managed wetlands would be monitored and adaptively managed to ensure that management options are implemented to avoid adverse effects on the western pond turtle.

- Operations and maintenance: Ongoing maintenance of BDCP facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and conservation actions described below.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where conservation measures are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic or upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1A would temporarily and permanently remove 233 acres of aquatic habitat and 752 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 128 acres of aquatic and 219 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat), and riparian restoration (CM7, 4 acres of upland habitat). All effects for seasonally inundated habitat restoration (CM5) would occur in the late-longterm.

Typical project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 233 acres of aquatic habitat should be restored, 233 acres of aquatic habitat should be protected, and 1,504 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, Objective MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1).In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation. Because the number of acres required to meet the typical ratios described above would be only 233 acres of aquatic communities protected and restored and 1,504 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1A on western pond turtles would not be adverse.

The plan also contains commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM17 Western Pond Turtle*. These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 1A would remove 286 acres of aquatic habitat and 1,383 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 1A as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, Objective MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

NEPA Effects: In the near-term, the loss of western pond turtle habitat under Alternative 1A would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of western pond turtle habitat associated with Alternative 1A, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, the effects of Alternative 1A as a whole on western pond turtle would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because *CM1 Water Facilities and Operation* construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 1A would temporarily and permanently remove 233 acres of aquatic habitat and 752 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 128 acres of aquatic and 219 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat, and riparian restoration (CM7, 4 acres of upland habitat). All effects for seasonally inundated habitat restoration (CM5) would occur in the late-longterm.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 233 acres of aquatic habitat should be restored, 233 acres of aquatic habitat should be protected, and 1,504 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, Objective MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1).In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation for CEQA purposes. Because the number of acres required to meet the typical ratios described above would be only 233 acres of aquatic communities protected and restored and 1,504 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1A on western pond turtles would be less than significant.

In addition, the plan also contains commitments to implement AMM1–AMM6, AMM10, and AMM17 which include elements that would avoid or minimize the risk of directly and indirectly affecting habitats and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 1A would remove 286 acres of aquatic habitat and 1,383 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 1A as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, Objective MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

The loss of western pond turtle habitat associated with Alternative 1A as a whole would represent an adverse effect as a result of special-status species habitat modification and the potential direct mortality of turtles. However, considering the habitat restoration and protection associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, which would be in place throughout the construction phase, the loss of habitat and potential mortality would not have an adverse effect on western pond turtle. Therefore, the loss of western pond turtle habitat and potential mortality of turtles resulting from Alternative 1A would have a less-than-significant impact on western pond turtle.

Impact BIO-53: Indirect Effects of Plan Implementation on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting, overwintering, and dispersal habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances over the term of the BDCP.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

Water operations would affect salinity gradients in Suisun Marsh. This effect mechanism cannot be disaggregated from tidal natural community restoration in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh will generally increase as a result of water operations and operation of salinity control gates to mimic a more natural water flow. Results of modeling for full implementation of the BDCP show salinity to double by the late long-term compared with current conditions during late fall and winter months. Changes in salinity would not be uniform across Suisun Marsh, as salinity would likely be more pronounced in some tidal channels and sloughs than others, and most of the salinity increase would occur during the fall and winter. Western pond turtles are primarily a freshwater species, although they can also be found in brackish marsh, and could respond negatively to increased salinity in Suisun Marsh. However, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not connected to tidal channels and sloughs in Suisun Marsh which is where increases in salinity would occur. Therefore, the potential effects associated with changes in salinity are not expected to adversely affect western pond turtles

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17, Alternative 1A would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. Changes in water salinity would have a less-than-significant impact on western pond turtles because most of the salinity increases would occur in areas not used extensively by western pond turtles. With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 1A construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 1A would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement would result in periodic inundation that could affect western pond turtle and its upland habitat. BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect from an estimated 283 acres of habitat during 1,000 cfs notch flow to an estimated 798 acres of habitat during 4,000 cfs notch flow. This effect would occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal overwintering habitat for the western pond turtle under Existing Conditions. Furthermore, Yolo Bypass inundation is not expected to affect nesting western pond turtles because operations would not occur during the nesting season (approximately May through October). Therefore, Yolo Bypass operations are expect to have a minimal effect, if any, on western pond turtles in the Yolo Bypass.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 331 acres of upland habitat for the western pond turtle in the south Delta (CZ 7). Seasonal flooding in restored floodplains is not expected to adversely affect aquatic and dispersal habitat, because these habitat functions are expected to remain in the seasonally inundated floodplains. Floodplains are not expected to be inundated during the nesting season, however, turtle hatchlings may overwinter in the nest and could be affected by flooding. Restored floodplains would transition for areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more); adverse effects on turtle hatchlings are most likely at the lower elevations of the restored floodplain, where frequent flooding occurs.

***NEPA Effects*:** Periodic effects on upland habitat for western pond turtle from CM2 and CM5 associated with implementing Alternative 1A are not expected to result in substantial adverse effects either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Therefore, Alternative 1A would not adversely affect the species.

***CEQA Conclusion*:** Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect 283-798 acres from CM2 and approximately 331 acres from CM5 of upland habitat for western pond turtle These acreages represent only 1% of the total upland western pond turtle habitat in the study area. Most of the increase in inundation would occur in the winter and early spring months, when western pond turtles may be in the water or overwintering and occupying upland habitats. Therefore, implementing Alternative 1A, including

AMM1–AMM6, AMM10, and AMM17, would not be expected to result in substantial adverse effects on western pond turtle, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Periodic effects of inundation under Alternative 1A would have a less-than-significant impact on the species.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 1A on the silvery legless lizard, San Joaquin coachwhip, and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10), which would not be affected by construction or restoration activities. This species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7) and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the coachwhip in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4) Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013). In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Alternative 1A is expected to result in the temporary and permanent removal of habitat that special-status reptiles uses for cover and dispersal (Table 12-1A-24). BDCP actions that could affect this habitat are limited to construction and maintenance of the water conveyance facilities in the vicinity of Clifton Court Forebay, and grassland restoration, protection and management. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP that would also benefit special-status reptiles (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-24. Changes in Special-Status Reptile Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	171	171	167	167	NA	NA
Total Impacts CM1		**171**	**171**	**167**	**167**	**NA**	**NA**
CM2–CM18	Grassland	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**171**	**171**	**167**	**167**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 1A conservation measures would result in a total loss of 338 acres of potential habitat for special-status reptiles (Table 12-1A-24). Water conveyance facilities and transmission line construction, including establishment and use of borrow and spoil areas, (CM1) would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effect are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though this assumption would result in slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4, where San Joaquin coachwhip does not occur.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, potentially impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to conservation components could have similar affects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 171 acres of habitat for special-status reptiles in the vicinity of

Clifton Court Forebay. Construction-related effects would temporarily disturb 167 acres of suitable habitat for special-status reptiles in the study area.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. *P. blainvillii* may only be active during the early morning and evening hours in the summer (Morey 2000). Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1A would remove 338 acres of grassland habitat for special-status reptiles from CM1. The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that 676 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55. to avoid and minimize injury or mortality of special-status reptiles during construction, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species from Alternative 1A would not be an adverse effect.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of 338 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the study area (Objective GNC1.1 and GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A, *Covered Species Accounts*). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because the Alternative 1A would result in a net increase in acreage of grassland habitat in the Plan Area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

NEPA Effects: In the near-term and late long-term, the loss of special-status reptile habitat under Alternative 1A would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above and because of the implementation of Mitigation Measure BIO-55 and applicable AMMs.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide

sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA.

Alternative 1A would remove 338 acres of grassland habitat for special-status reptiles from CM1. The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that 676 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which would is close enough to the timing of construction impacts to constitute mitigation for CEQA purposes. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species would be less than significant.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of 338 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the study area (Objective GNC1.1 and GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because the Alternative 1A would result in a net increase in acreage of grassland habitat in the Plan Area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species would be less than significant.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support non-covered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work areas, the biologist will first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas of suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, AMMs, specifically *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, and *AMM6 Disposal and Reuse of Spoils*, will be implemented for all noncovered special-status reptiles adversely affected by the BDCP to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Plan Implementation on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat over the term of the BDCP. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These effects would be reduced through implementation of *AMM10 Restoration of Temporarily Affected Natural Communities*.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

NEPA Effects: Implementation of the Mitigation Measure BIO-55 and AMM10 would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measures would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55 and AMM10, the indirect effects of Alternative 1A on special-status reptiles would not be adverse under NEPA.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

With implementation of Mitigation Measure BIO-55 and AMM10 as part of Alternative 1A construction, operation, and maintenance, the BDCP would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55 and AMM10, the indirect effects of Alternative 1A would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on the California black rail. The habitat model used to assess effects on the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta consists of all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially, instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat consists of all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones, providing refugia during high tides, within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of California black rail modeled habitat, as indicated in Table 12-1A-25. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the California black rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).

- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 1,700 acres of black rail habitat between restored tidal freshwater emergent wetlands and transitional uplands to provide upland refugia (Objective CBR1.1, associated with CM4).
- Create topographic heterogeneity in restored tidal brackish and freshwater emergent wetlands (Objectives TBEWNC1.4 and TFEWNC2.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*), AMM1–AMM7, *AMM38 California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-25. Changes in California Black Rail Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	3	3	1	1	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**3**	**3**	**1**	**1**	**NA**	**NA**
CM2–CM18	Primary	76	84	0	0	0	0
	Secondary	986	3,044	0	0	0	0
Total Impacts CM2–CM18		**1,062**	**3,128**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,065**	**3,131**	**1**	**1**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 88 acres of modeled primary habitat, and up to 3,044 acres of modeled secondary habitat for California black rail (Table 12-1A-25). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1) and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11) activities, which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below. A summary statement of the combined NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 4 acres of modeled California black rail habitat, composed of 1 acre of primary, and 3 acres of secondary habitat (Table 12-1A-25). Of the 4 acres of modeled habitat that would be removed, 1 acre would be a temporary loss of primary habitat. Activities that would impact modeled habitat consist of tunnel construction, temporary access roads, and construction of transmission lines in the central Delta in CZ 5 (between Bouldin and Venice Islands), CZ 6 (east of Bacon Island), and CZ 8 (at the north end of Coney Island). The construction footprint for CM1 does not overlap with any California black rail occurrences. The implementation of *AMM38 California Black Rail* would minimize the effects of construction on adjacent rails if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction or channel modification from fish passage improvements associated with the Yolo Bypass would result in the permanent removal of approximately 5 acres of primary California black rail habitat in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1A implementation.
- *CM4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be affected by tidal marsh restoration. Some California black rail modeled habitat would be permanently lost such that it no longer serves as habitat, while other modeled habitat would change value through conversion from one habitat type to another. Tidal habitat restoration site preparation and inundation would result in the permanent loss of 79 acres of primary habitat and 3,044 acres of secondary habitat for California black rail. Of the 79 acres of primary habitat lost, an estimated 76 acres would be converted to low marsh, or secondary habitat, for the species due to increased water elevations.

  The majority of the effects of tidal natural communities restoration would occur in Suisun Marsh (CZ 11). Much of the natural wetland habitat that would be removed occurs in isolated patches and would be replaced by larger continuous areas of tidal wetlands that are expected to support higher habitat functions for the rail than the impacted wetlands. As described in the BDCP, restoration of up to 24,000 acres of tidal freshwater emergent wetland in the Delta and at least 6,000 acres of tidal brackish emergent wetland natural communities in CZ 11 by the late long-term would benefit California black rail. The primary habitat for the species in the Delta consists of inchannel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under CM4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration projects would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

  The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before the initiation of restoration actions in other areas. However, California black rails have a greater use of mature tidal marshes and, therefore, it would be years before the newly restored marshes provided suitable habitat for the species. In the long-term, tidal natural communities restoration is expected to have little to no adverse effects on California black rail habitat because the habitat removed would be replaced by a greater acreage of high-value tidal wetland and, thus, is expected to provide a benefit for California black rail.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions contained in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values over the term of the BDCP. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below. Additional actions under CM11 include the control of nonnative predators to reduce nest predation as needed.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the surrounding habitat in Suisun and the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California black rail. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction outside of the breeding season where feasible (reducing the risk of impacting active nests), construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of the species during construction, as required by AMM1–AMM7 and *AMM38 California Black Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1A implementation, there would be a loss of 1,066 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 4 acres of primary habitat), and implementing other conservation measures (CM2 Yolo

Bypass Fisheries Enhancement and CM4 Tidal Natural Communities Restoration–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 4 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California black rail satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, AMM7 Barge Operations Plan,* and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, E*nvironmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 88 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

NEPA Effects: The loss of California black rail habitat and potential direct mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by the biological objectives for the species and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*, which would be in place during all project activities, the effects of Alternative 1A as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1A implementation, there would be a loss of 1,066 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 4 acres of primary habitat), and implementing other conservation measures (CM2 Yolo Bypass Fisheries Enhancement and CM4 Tidal Natural Communities Restoration–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 4 acres of tidal natural communities should be restored/created to mitigate the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM38 California Black Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. The 10,850 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for

California black rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 88 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of

Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California black rail.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of California black rail. A variety of rail species is known to suffer mortality from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al. 1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires. California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the Plan Area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al 1994). However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would eliminate any potential for mortality of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for transmission lines constructed in the Delta to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines and select existing powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California black rail because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Plan Implementation on California Black Rail

Indirect construction-related effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in AMM38 (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*) that preconstruction surveys of potential breeding habitat would be conducted within 700 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure:

The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on Black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008); however, the majority of the overlap between restoration areas and black rail habitat is within Suisun Marsh, where conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on California black rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California black rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27, Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances related to construction-related activities from conservation measures could disturb California black rail habitat adjacent to work sites. Potential adverse effects of noise and visual disturbances on California black rail would be minimized with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration actions that would create high and low tidal marsh, which is black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROAs do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities and other conservation measures could disturb primary and secondary California black rail habitat adjacent to work sites. *AMM38 California Black Rail* would avoid and minimize impacts on California black rail from noise and visual disturbance. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species. These impacts on California black rail would be less than significant with the incorporation of AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration actions that would create high and low tidal marsh, which is black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROAs do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and could temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *CM4 Tidal Natural Community Restoration* activities. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would not result in the periodic inundation of modeled habitat for California black rail. There are no records for California black rails in the Yolo Bypass, although the species is highly secretive and the extent to which the area has been surveyed for California black rails is unknown. Therefore, there is potential for the species to occur in the Yolo Bypass. In addition, rails may occur in the bypass after restoration activities are completed. However, periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in increased magnitude, frequency and duration of periodic inundation by up to 6 acres of modeled California black rail habitat in CZ 7. The risk of changes in inundation frequency, magnitude, and duration through CM2 and CM5 affecting California black rail are considered to be low, and would not be expected to result in adverse effects on the species.

NEPA Effects: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration through CM2 and CM5 affecting California black rail is considered to be low.

CEQA Conclusion: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would represent a less-than-significant impact on California black rail because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration as a result of CM2 and CM5 affecting California black rail is considered to be low.

California Clapper Rail

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on California clapper rail. California clapper rail habitat includes mostly middle marsh habitat with select emergent wetland plant alliances. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and forage. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Covered Species Accounts*.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-1A-26. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the California clapper rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM38 California Black Rail*, and *AMM27 Selenium Management*, impacts on the California clapper rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-26. Changes in California Clapper Rail Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	26	27	0	0	NA	NA
	Secondary	50	50	0	0	NA	NA
Total Impacts CM2–CM18		**76**	**77**	**0**	**0**	**NA**	**NA**
TOTAL IMPACTS		**76**	**77**	**0**	**0**	**NA**	**NA**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

Alternative 1A conservation measures would result in the total loss or conversion of up to 35 acres of modeled California clapper rail habitat consisting of 27 acres of primary habitat and 8 acres of secondary habitat (Table 12-1A-26). The conservation measure that would result in these losses is tidal natural communities restoration (CM4). The conservation measure that would result in these losses is tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would convert approximately 35 acres of modeled California clapper rail habitat, primarily in CZ 11. The tidal marsh restoration action would not result in the permanent loss of any California clapper rail habitat in the Plan Area. However, approximately 27 acres of primary habitat would be converted to secondary low marsh habitat and 8 acres of secondary habitat would be converted to middle or high marsh. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11. Tidal wetlands would be restored as a mosaic of large, interconnected, and biologically diverse patches that supported a natural gradient extending from subtidal to the upland fringe. Much of the restored tidal brackish emergent wetland would meet the primary habitat requirements of the California clapper rail, including development of mid- and high-marsh vegetation with dense, tall stands of pickleweed cover. Restoration would be sequenced and spaced in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.

- *CM11 Natural Communities Enhancement and Management*: Because the entire California clapper rail population is restricted to the San Francisco Bay Area estuary, BDCP enhancement and restoration actions would be expected to benefit the species by creating the potential for extending its abundance and distribution in Suisun Marsh. Occupied California clapper rail habitat would be monitored to determine if there is a need for predator control actions. If implemented, nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats could result in localized ground disturbances that could temporarily remove small amounts of California clapper rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available California clapper rail habitat. These potential effects are currently not quantifiable, but would be minimized with implementation *AMM19 California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect California clapper rail use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, and habitat restoration, enhancement, and management could result in injury or mortality of California clapper rail. Operation of construction equipment could result in injury or mortality of California clapper rails. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is less likely as these individuals are expected to avoid contact with construction equipment. However, nest sites would be avoided during the nesting season as required by AMM1–AMM7 and *AMM19 California Clapper Rail.*

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to compensate for the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4). These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 50 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and at least 1,500 acres of the restored marsh would consist of middle-and high-marsh vegetation, serving as primary habitat for California clapper rail in Suisun Marsh (Objectives TBEWNC1.1 and TBEWNC1.2). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of other conservation actions, the loss of California clapper rail habitat associated with Alternative 1A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with CM4, guided by biological goals and objectives and *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*, which would be in place during all project activities, the effects of Alternative 1A as a whole on California clapper rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term from the implementation of *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the study area. These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that

creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4).

These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of restoration impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM19 California Clapper Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 76 acres of restored tidal natural communities, the 2,000 acres of tidal brackish emergent wetland restoration contained in the near-term Plan goals, and the additional detail in the biological objectives for California clapper rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 8 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed, serving as primary habitat for clapper rail in Suisun Marsh (Objective TBEWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California clapper rail.

Impact BIO-63: Indirect Effects of Plan Implementation on California Clapper Rail

Indirect construction-related effects: California clapper rail habitat within the vicinity of proposed restoration areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California clapper rail. The use of mechanical equipment during construction-related restoration activities could cause the accidental release of petroleum or other contaminants that could affect clapper rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM19 California Clapper Rail* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*) that preconstruction surveys of potential breeding habitat would be conducted within 500 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Preconstruction surveys conducted under *AMM19 California Clapper Rail* would ensure construction-related noise and visual disturbances would not have an adverse effect on California clapper rail. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and ensure measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Therefore, with the implementation of AMM1–AMM7 and *AMM19 California Clapper Rail*, there would be no adverse effect on California clapper rail.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which would be beneficial to California clapper rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rails are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on California clapper rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the California clapper rail. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California clapper rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California clapper rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California clapper rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. Potential

effects of noise and visual disturbances on California clapper rail would be minimized with *AMM19 California Clapper Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, changes in salinity, and increased exposure to selenium from Alternative 1A implementation would not have an adverse effect on California clapper rail.

CEQA Conclusion**:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb approximately 542 acres of California clapper rail habitat adjacent to work sites. *AMM19 California Clapper Rail* would avoid and minimize impacts on California clapper rail from noise and visual disturbance. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants or the inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat, which could also affect the species. These impacts on California clapper rail would be less than significant with the incorporation of AMM1–AMM7 into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California clapper rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of Alternative 1A implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the Plan Area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges from 0.3 acre to 8 acres (0.1 to 3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to movements of California clapper rail. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and, thus, temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California clapper rail or restoration activities resulting in barriers to movement would be minimized through sequencing of restoration activities to minimize effects of temporary habitat loss. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail. Therefore, California clapper rail habitat fragmentation would not have an adverse effect on the species.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California clapper rail as a result of special-status species habitat modification because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California clapper rail as a result of special status species habitat modification because Tidal Natural Communities Restoration (CM4) would be phased to allow for the recovery of some areas before initiating restoration actions in other areas. In addition, In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

California Least Tern

This section describe the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of California least tern modeled habitat as indicated in Table 12-1A-27. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit California least tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect at least 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the at least 65,000 acres of tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation).

As explained below, with the restoration and protection of tidal perennial aquatic foraging habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and mitigation to avoid impacts on terns should they nest in the study area, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-27. Changes in California Least Tern Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	48	48	133	133	NA	NA
Total Impacts CM1		**48**	**48**	**133**	**133**	**NA**	**NA**
CM2–CM18	Foraging	38	46	11	16	NA	NA
Total Impacts CM2–CM18		**38**	**46**	**11**	**16**	**NA**	**NA**
TOTAL IMPACTS		**86**	**94**	**144**	**149**	**NA**	**NA**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 243 acres (94 acres of permanent loss, 149 acres of temporary loss) of modeled foraging habitat for California least tern (Table 22-1A-27). The conservation measures that would result in these losses are construction of water conveyance facilities and operation (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 181 acres of modeled California least tern aquatic foraging habitat (Table 22-1A-27). Of the 181 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 48 acres would be a temporary loss. Most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The temporary effects on California least tern foraging habitat would occur at numerous locations, including in the Sacramento River at Intakes 1–5, and at temporary barge unloading facilities established along the tunnel route. The CM1 footprint does not overlap with any California least tern occurrences. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized,* (described below) would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on terns were they to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancement (CM2) would result in the permanent loss of 8 acres and the temporary loss of 11 acres of modeled aquatic foraging habitat for California least tern in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1A implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration actions would result in the permanent loss of 36 acres of modeled aquatic foraging habitat for California least tern. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic would be restored, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration is consistent with BDCP Objective TPANC1.1. Tidal perennial aquatic restoration would be expected to substantially increase the primary productivity of fish, increasing the prey base for California least tern. Approximately 3,400 acres of the restoration would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be phased over the following 30 years. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would result in the permanent loss of 2 acres and the temporary loss of 5 acres of modeled aquatic foraging habitat for California least tern. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers.
- *CM11 Natural Communities Enhancement and Management:* Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and injury mortality and noise and visual disturbance of nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic post construction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the BDCP. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs described below.

Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in Suisun Marsh and west Delta area (CZ 10 and CZ 11). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or mortality would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraphs summarize the combined effects discussed above, describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions area also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1A implementation, there would be a loss of 230 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 181 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 230 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3).This conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*) (Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The California least tern is not a species that is covered under the BDCP. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this potential effect on nesting California least terns.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 243 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* would restore an estimated 27,000 acres of high quality tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1A would represent an adverse effect in the absence of other conservation actions. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or where artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies*, would be available to address this potential effect on nesting California least terns. With habitat restoration associated with CM4, and with implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 1A as a whole on California least tern would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1A implementation, there would be a loss of 230 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 181 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 230 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3). Modeling conducted by ESA PWA indicates that this conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Spoils, Reusable Tunnel Material,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would reduce this impact on nesting California least terns to a less-than–significant level.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, AMM1–AMM7 and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 230 acres of restored tidal perennial aquatic habitat, the 3,400 acres of tidal perennial aquatic restoration estimated in the near-term, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 243 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore an estimated 27,000 acres of high-value tidal perennial aquatic natural community (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

In the absence of other conservation actions, the loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1A would represent a significant impact in the absence of other conservation actions.

However, with habitat restoration associated with CM4, and with implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, the loss of habitat or mortality under this alternative would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet of California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of Plan Implementation on California Least Tern

Indirect construction-and operation-related effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills from occurring or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and large mouth bass tissues were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in the BDCP Appendix 5.D, *Contaminants*).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would be available to address this potential adverse effect. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM12, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of mortality of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would substantially reduce the potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of direct mortality of a special-status species because terns are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of direct mortality of a special-status species because terns are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes "roosting and foraging" and "foraging" habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (BDCP Appendix 2A, *Covered Species Accounts*).

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-1A-28. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).

- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).

- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-28. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Roosting and Foraging - Permanent	2	2	1	1	NA	NA
	Roosting and Foraging - Temporary	319	319	89	89	NA	NA
	Foraging	1,650	1,650	902	902	NA	NA
Total Impacts CM1		**1,972**	**1,972**	**992**	**992**		
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	2,776	4,367	0	0	0	0
Total Impacts CM2–CM18		**2,776**	**4,408**	**0**	**0**	**0**	**0**
Total Roosting/Foraging – Permanent		**2**	**2**	**1**	**1**	**0**	**0**
Total Roosting/Foraging – Temporary		**319**	**360**	**89**	**89**		
Total Foraging		**4,426**	**6,017**	**902**	**902**	**0**	**0**
TOTAL IMPACTS		**4,748**	**6,380**	**992**	**992**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 452 acres of modeled roosting and foraging habitat for greater sandhill crane (362 acres of permanent loss and 90 acres of temporary loss) and 6,919 acres of foraging habitat for greater sandhill crane (6,017 of permanent loss, 902 acres of temporary loss, Table 12-1A-28). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities as they are currently designed would result in the combined permanent loss of up to 2,964 acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 2 acres of permanent roosting and foraging habitat, 319 acres of temporary roosting and foraging habitat, and 1,650 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 648 acres of very high-value, 1 acres of high-value, and 735 acres of medium-value foraging habitat (Table 12-1A-29). In addition, 1 acre of permanent roosting and foraging habitat, 89 acres of temporary roosting and foraging habitat, and 902 acres of foraging habitat would be temporarily removed (Table 12-1A-28). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. CM1 activities that would result in temporary impacts would include temporary access roads, borrow and spoil sites, and work areas for construction.

  The permanent roosting and foraging habitat that would be permanently removed is located on the south end of Staten Island and the loss would be from the installation of a permanent transmission line. The temporary roost site on Tyler Island would be permanently impacted by a RTM storage area, a tunnel shaft, and a permanent transmission line and temporarily impacted by a concrete batch plant, fuel station, temporary work area, and temporary transmission line. Staten Island is among the most significant crane use areas in the Delta (Littlefield and Ivey 2000) and construction on or adjacent to Staten Island would be adverse in the absence of other conservation measures. Temporary roosts on Bouldin Island, Venice Island, and Bacon Island would also be impacted by the proposed footprint for temporary and permanent transmission lines.

  Approximately 288 acres of the Tyler Island temporary roost site in addition to 406 acres of the permanent loss of foraging habitat would result from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane*, in Appendix 3B, *Environmental*

Commitments, AMMs, and CMs). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for injury and direct mortality from electrical transmission facilities is addressed below under Impact BIO-70. The transmission line alignment under Alternative 1A is not fully designed and the final transmission line design would be determined in coordination with USFWS, CDFW, and a qualified crane biologist to achieve a performance standard of no net increase in bird strike hazard to greater sandhill cranes in the Plan Area (*AMM20 Greater Sandhill Crane*).

Other CM1 impacts on greater sandhill crane foraging habitat would occur from construction of Intakes 1–5, associated work areas and potential borrow and spoil sites, tunnel shafts, and tunnel work areas, barge unloading facilities, transmission line footprints, and concrete batch plants. Approximately 910 acres of the permanent impact on foraging habitat would occur from the construction of the intermediate forebay west of the Stone Lakes National Wildlife Refuge. The intermediate forebay would be located within 500 feet of traditional sandhill crane roosting and foraging habitat, which could cause cranes to abandon these roost sites. The indirect effects of noise and visual disturbance from construction and operation of CM1 water conveyance facilities is discussed under Impact BIO-71. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations.

Table 12-1A-29. Total Amount of Permanently Affected Greater Sandhill Crane Foraging Habitat

Foraging Habitat Value Class	Land Cover Type	Acres Affected by CM1 permanent (temporary)	Acres Affected by CM2–CM18 permanent (temporary)
Very high	Corn, rice	648 (230)	1,155 (0)
High	Wheat, managed wetlands,	1 (75)	489 (0)
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	735 (329)	1,403 (0)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	257 (342)	1,320 (0)
Total		**1,650(976)**	**4,367**

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 2,754 acres of greater sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 2,713 acres of foraging habitat. Lost foraging habitat from CM4 would consist of 716 acres of very high-value, 304 acres of high value, 873 acres of medium-value, and 821 acres of low-value foraging habitat This loss would occur in the Cosumnes-Mokelumne River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. In CZ 5, loss of modeled habitat would occur along the western edge of the greater sandhill crane winter use area and therefore would not result in fragmentation of traditional crane habitats. Therefore fragmentation of habitat from tidal restoration activities would be expected to be minimal. Approximately 1,951 acres of foraging habitat would be impacted within the first 10 years of Alternative 1A implementation.

- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands that provide foraging habitat for greater sandhill crane would be converted to grassland by the late long-term timeframe. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the greater sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Plan implementation.

- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the greater sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 1A implementation.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, greater sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of Alternative 1A implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by AMMs, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. The potential for injury and direct mortality from electrical transmission facilities is discussed below under Impact BIO-70.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 411 acres roosting and foraging habitat (321 acres of permanent loss, 90 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 6,069 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,294 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 3,953 acres would be moderate- to very high-value habitat (CM1, 2,018 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 411 acres of greater roosting habitat should be restored/created and 411 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 2,018 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,927 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 53 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses. Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a, *Compensate for the Loss of Medium- to Very High-Value Greater Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 462 acres of roosting and foraging habitat (2% of the total habitat in the study area) and 6,919 acres of foraging habitat (4% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 5,065 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites

were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

To compensate for near-term impacts on crane roosting and foraging habitat, 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). To create additional high-value foraging habitat in the study area, 10% of these acres of protected foraging habitat would result from the conversion of low-value or nonhabitat areas to high- or very high-value habitat (Objective GSHC1.2). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering habitat protection, restoration, management, and enhancement would be guided by performance standards, and the aforementioned AMMs, which would be in place throughout the period of construction, greater sandhill crane habitat losses and conversions under Alternative 1A would not be an adverse effect under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 411 acres roosting and foraging habitat (321 acres of permanent loss, 90 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 6,069 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,294 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 3,953 acres would be moderate- to very high-value habitat (CM1, 2,018 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 411 acres of greater roosting habitat should be restored/created and 411 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 2,018 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 53 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses. Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 462 acres of roosting and foraging habitat (2% of the total habitat in the study area) and 6,919 acres of foraging habitat (4% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 5,065 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

To compensate for near-term impacts on crane roosting and foraging habitat, 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). To create additional high-value foraging habitat in the study area, 10% of these acres of protected foraging habitat would result from the conversion of low-value or nonhabitat areas to high- or very high-value habitat (Objective GSHC1.2). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 1A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Considering Alternative 1A's protection and restoration provisions, in addition to Mitigation Measure BIO-69a, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1 prior to or concurrent with impacts, loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 1A would have a less-than-significant impact on greater sandhill crane.

Mitigation Measure BIO-69a: Compensate for the loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat

DWR will compensate for the loss of greater sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent within the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging habitat value categories are listed in Table 12-1A-29. Foraging habitat conservation must occur within the greater sandhill crane winter use area and the location of protected habitat or conservation easements must be preapproved by USFWS and CDFW.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. Because lines cross over or surround sandhill crane roost sites in the study area, this existing network of power lines in the study area currently poses a collision and electrocution risk for sandhill cranes.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 1A facilities. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1A was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Typically, higher-voltage (230- kV) lines vary in height from 90 to 110 feet, while subtransmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1A alignment would require the installation of approximately 52 miles of permanent transmission line (43 miles of 230-kV lines and 9 miles of 69-kV lines) extending north and south through much of the crane use area. The temporary transmission lines would total approximately 48 miles (25 miles of 69-kV line and 23 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years. Staten Island is one of the most important wintering sites for greater sandhill cranes in the Delta, and the proposed permanent and temporary transmission lines that would be constructed on Tyler Island and Staten Island would have the potential to substantially affect greater sandhill cranes.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1A meets the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee

(2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed for the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994).Placing diverters on existing lines would be expected to reduce existing mortality in the Plan Area and, therefore, result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1A is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1A is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1A would would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of Plan Implementation on Greater Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 1A water conveyance facilities on greater sandhill crane (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The analysis addressed the potential noise effects on cranes, and concluded that as much as 6,508-18,284 acres of crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). This would include 107–814 acres of permanent crane roosting habitat, 761–2,063 acres of temporary crane roosting habitat, and 5,640–15,407 acres of crane foraging habitat. In addition, 86–730 acres of permanent crane roosting habitat, 252–1,118 acres of temporary crane roosting habitat, and 778–4,957 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-1A-30). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-1A-30. Greater Sandhill Crane Habitat Affected By General Construction and Pile Driving Noise Under Alternative 1A (acres)

	General Construction		Pile Driving	
Habitat Type	Above 60 dBA	Above 50 dBA	Above 60 dBA	Above 50 dBA
Permanent Roosting	107	814	86	730
Temporary Roosting	761	2,063	252	1,118
Foraging	5,640	15,407	778	4,957
Total Habitat	**6,508**	**18,284**	**1,116**	**6,805**

dBA = A-weighted decibel

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure:

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on greater sandhill crane. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Therefore, potential indirect effects of increased mercury exposure is likely low for greater sandhill cranes because they primarily forage on cultivated crops. Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect greater sandhill crane via uptake in lower trophic levels (see BDCP Appendix

5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day, and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate for affected habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium, which could result in the potential mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for greater sandhill cranes because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Crane habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20*

Greater Sandhill Crane would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate impacts on affected habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium. which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in greater sandhill cranes would not be expected to measurably increase as a result of water operations under CM1 compared with the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for greater sandhill cranes because they primarily forage on cultivated crops. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1A would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on greater sandhill crane.

Lesser Sandhill Crane

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. These habitat types include suitable foraging and roosting habitat in the study area as certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser Sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-1A-31. Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP for the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*) that would also benefit the lesser sandhill crane.

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).
- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).
- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).

- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would be less than significant for CEQA purposes.

Table 12-1A-31. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Roosting and Foraging - Permanent	2	2	1	1	NA	NA
	Roosting and Foraging - Temporary	319	319	89	89	NA	NA
	Foraging	2,225	2,225	1,069	1,069	NA	NA
Total Impacts CM1		**2,546**	**2,546**	**1,159**	**1,159**		
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	3,610	12,131	2	4	0	0
Total Impacts CM2–CM18		**3,610**	**12,172**	**2**	**4**	**0**	**0**
Total Roosting and Foraging - Permanent		**2**	**2**	**1**	**1**	**0**	**0**
Total Roosting and Foraging - Temporary		**319**	**360**	**89**	**89**		
Total Foraging		**5,835**	**14,356**	**1,071**	**1,073**		
TOTAL IMPACTS		**6,156**	**14,718**	**1,161**	**1,163**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 452 acres of modeled roosting and foraging habitat (362 acres of permanent loss and 90 acres of temporary loss) and 15,426 acres of foraging habitat (14,356 acres of permanent loss and 1,073 acres of temporary loss) for lesser sandhill crane (Table 12-1A-31). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Improvements (CM2), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities as they are currently designed would result in the combined permanent and temporary loss of up to 2,964 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 2 acres of permanent roosting and foraging habitat, 319 acres of temporary roosting and foraging habitat, and 2,225 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 1,320 acres of very high-value, 51 acres of high-value, and 384 acres of medium-value foraging habitat (Table 12-1A-32). In addition, 1 acre of permanent roosting and foraging habitat, 89 acres of temporary roosting and foraging habitat, and 1,069 acres of foraging habitat would be temporarily removed (Table 12-1A-31). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. CM1 activities that would result in temporary impacts would include temporary access roads, borrow and spoil sites, and work areas for construction.

  The permanent roosting and foraging habitat that would be permanently removed is located on the south end of Staten Island and the loss would be from the installation of a permanent transmission line. The temporary roost site on Tyler Island would be permanently impacted by a RTM storage area, a tunnel shaft, and a permanent transmission line and temporarily impacted by a concrete batch plant, fuel station, temporary work area, and temporary transmission line. Staten Island is among the most significant crane use areas in the Delta (Littlefield and Ivey 2000) and construction on or adjacent to Staten Island would be adverse in the absence of other conservation measures. Temporary roosts on Bouldin Island, Venice Island, and Bacon Island would also be impacted by the proposed footprint for temporary and permanent transmission lines.

  Approximately 288 acres of the Tyler Island temporary roost site in addition to 406 acres of the permanent loss of foraging habitat would result from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for injury and direct mortality from electrical transmission facilities is addressed below under Impact BIO-73. The transmission line alignment under Alternative 1A is not fully designed and the final transmission line design would be determined in coordination with USFWS, CDFW, and a qualified crane biologist to achieve a performance standard of no net increase in bird strike hazard to greater sandhill cranes in the Plan Area (*AMM20 Greater Sandhill Crane*). This performance standard would similarly protect lesser sandhill cranes from transmission line impacts.

Other CM1 impacts on lesser sandhill crane foraging habitat would occur from construction of Intakes 1-5, associated work areas and potential borrow and spoil sites, tunnel shafts, and tunnel work areas, barge unloading facilities, transmission line footprints, and concrete batch plants. Approximately 910 acres of the permanent impact on foraging habitat would occur from the construction of the intermediate forebay west of the Stone Lakes National Wildlife Refuge. The intermediate forebay would be located within 500 feet of traditional sandhill crane roosting and foraging habitat, which could cause cranes to abandon these roost sites. The indirect effects of noise and visual disturbance from construction and operation of CM1 water conveyance facilities is discussed under Impact BIO-74. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1A-32. Total Amount of Lesser Sandhill Crane Foraging Habitat Affected by Habitat Value

Foraging Habitat Value Class	Land Cover Type	CM1 Permanent (Temporary)	CM2–CM18 Permanent (Temporary)
Very high	Corn, alfalfa and alfalfa mixtures	1,320 (348)	4,083 (0)
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	51 (146)	2,058 (0)
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, non-irrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	384 (354)	2,220 (2)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	456 (196)	3,745 (2)
None	Vineyards, orchards	14 (26)	23 (0)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction under CM2 would result in a permanent loss of 267 acres and a temporary loss of 2 acres of lesser sandhill crane foraging habitat in CZ 2. Lesser sandhill crane use in this area is less common than in the central Delta. Construction impacts from CM2 would occur within the first 10 years of Plan implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 10,248 acres of lesser sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 10,207 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 3,642 acres of very high-value, 1,529 acres of high-value, 2,040 acres of medium-value, and 2,983 acres of low-value foraging habitat (Table 12-1A-32). Habitat loss would primarily occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. Lesser sandhill cranes are less traditional than greater sandhill cranes and would be more adaptable to changes in land use. Approximately 2,516 acres of foraging habitat would be removed within the first 10 years of Plan implementation.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees would result in the loss of 2 acres of low-value lesser sandhill crane foraging habitat (1 acre of permanent loss, 1 acres of temporary loss). This impact would occur after the first 10 years of Plan implementation.

- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands (foraging habitat) would be converted to grassland. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the lesser sandhill crane. Approximately 257 acres would be impacted within the first 10 years of plan implementation.
- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the lesser sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Plan implementation.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of plan implementation).
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by AMMs, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. Injury and mortality from electrical transmission facilities are described below under Impact BIO-73.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 411 acres roosting and foraging habitat (321 acres of permanent loss, 90 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 6,906 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,294 acres; *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 5,109 acres would be medium- to very high-value habitat (CM1, 2,602 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 411 acres of lesser sandhill crane roosting habitat should be restored/created and 411 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 2,602 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 411 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72, *Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 452 acres of roosting and foraging habitat (2% of the total habitat in the study area) and 15,426 acres of foraging habitat (6% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 10,965 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective

GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat and potential for direct mortality of this special status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration*, guided by biological goals and objectives for the species and by AMM1–AMM7*, AMM20 Greater Sandhill Crane*, which would be in place during all project activities, and Mitigation Measure BIO-72, which would be available to compensate for loss of medium- to very high-value foraging habitat, the effects of habitat loss and potential mortality on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 411 acres roosting and foraging habitat (321 acres of permanent loss, 90 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 6,906 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,294 acres; *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 5,109 acres would be medium- to very high-value habitat (CM1, 2,602 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 411 acres of lesser sandhill crane roosting habitat should be restored/created and 411 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 2,602 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 411 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72 would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 452 acres of roosting and foraging habitat (2% of the total habitat in the study area) and 15,426 acres of foraging habitat (6% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 10,965 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites

were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. The acres of foraging habitat conservation under Objective GSHC1.1 would not be sufficient to compensate for the habitat losses of lesser sandhill crane foraging habitat by the late long-term timeframe. The implementation of Mitigation Measure BIO-72, would require that of the 48,625 acres of cultivated lands protected by the late long-term timeframe, sufficient acres were conserved in suitable crop types for lesser sandhill cranes.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1A's protection and restoration provisions, in addition to Mitigation Measure BIO-72, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on lesser sandhill crane.

Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

DWR must compensate for the loss of lesser sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging value categories are listed in Table 12-1A-32. Foraging habitat conservation must occur within 10 kilometers of traditional sandhill crane roost sites and the location of protected habitat or conservation easements must be preapproved by CDFW.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are 11- to 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. Because lines cross over or surround sandhill crane roost sites, this existing network of power lines in the study area currently poses a collision and electrocution risk for sandhill cranes.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 1A facilities. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1A was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

Typically, higher-voltage (230-kV) lines vary in height from 90 to 110 feet, while subtransmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1A alignment would require the installation of approximately 52 miles of permanent transmission line (43 miles of 230-kV lines and 9 miles of 69-kV lines) extending north and south, through much of the crane use area. The temporary transmission lines would total approximately 48 miles (25 miles of 69-kV line and 23 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years. Staten Island is one of the most important wintering sites for greater sandhill cranes in the Delta, and the proposed permanent and temporary transmission lines that would be constructed on Tyler Island and Staten Island would have the potential to substantially affect both greater and lesser sandhill cranes.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1A meets the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for lesser sandhill crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed for the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and, therefore, result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Effects: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1A is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities which would also benefit the lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1A would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1A is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities which would also benefit lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1A would would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of Plan Implementation on Lesser Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 1A and to determine that as much as 6,508–18,284 acres of crane habitat could be affected by general construction noise above baseline level (50–60 dBA). This would include 107–814 acres of permanent crane roosting habitat, 761–2,063 acres of temporary crane roosting habitat, and 5,640–15,407 acres of crane foraging habitat. In addition, 86–730 acres of permanent crane roosting habitat, 252–1,118 acres of temporary crane roosting habitat, and 778–4,957 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-1A-30 under Impact-BIO-71). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on lesser sandhill crane as they primarily forage on cultivated crops and invertebrates. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect lesser sandhill crane via uptake in lower trophic levels (BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Crane habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane*, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on affected habitat.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Crane habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate for affected habitat, there would not be an adverse effect on lesser sandhill crane.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium, which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of A*MM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in lesser sandhill crane would not be expected to measurably increase as a result of water operations under CM1 compared with the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill cranes because they primarily forage on cultivated crops and associated invertebrates. Implementation of

CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on lesser sandhill crane.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1A would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on the least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-1A-33. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit least Bell's vireo and yellow warbler (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM7).
- Maintain and enhance structural heterogeneity (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation (Objective VFRNC2.2, associated with CM7).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-33. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Migratory and breeding	30	30	17	17	NA	NA
Total Impacts CM1		**30**	**30**	**17**	**17**	**NA**	**NA**
CM2–CM18	Migratory and breeding	382	656	88	109	48–85	148
Total Impacts CM2–CM18		**382**	**656**	**88**	**109**	**48–85**	**148**
TOTAL IMPACTS		**412**	**686**	**105**	**126**	**48–85**	**148**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 812 acres of modeled habitat (686 acres of permanent loss and 126 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-1A-33). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 47 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-1A-33). Of the 47 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 30 acres would be a permanent loss and 17 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss would occur where Intakes 1–5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Temporary losses would occur where pipelines cross Snodgrass Slough and other small waterways east of the Sacramento River, and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8.

Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least 4 years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancements (CM2) would permanently remove approximately 83 acres and temporarily remove 88 acres of modeled least Bell's vireo and yellow warbler habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled least Bell's vireo and yellow warbler habitat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 28 acres and temporarily remove 21 acres of modeled least Bell's vireo and yellow warbler habitat. Based on the riparian habitat restoration assumptions, a minimum of 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions.

  The actual number of acres of valley/foothill riparian habitat that CM4 and CM5 would restore may differ from these estimates, depending on how closely the actual outcome of tidal habitat restoration approximates the assumed outcome. However, riparian restoration from CM4 and CM5 would increase the extent of least Bell's vireo and yellow warbler habitat within the Plan Area once the restored riparian vegetation has developed habitat functions for these species.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat over the term of the BDCP. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the Plan Area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the Plan Area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbance that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Although least Bell's vireo nesting has not been confirmed in the Plan Area, recent occurrences in the Yolo Bypass and at the San Joaquin River National Wildlife Refuge suggest that the reestablishment of a breeding population is a possibility over the duration of the BDCP. construction-related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler if present in the study area because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 517 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 47 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 47 acres of valley/foothill riparian habitat should be restored/created and 47 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, AMM10*

Restoration of Temporarily Affected Natural Communities, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests were detected and avoided. Mitigation Measure BIO-75 would be available to address potential effects on nesting yellow warblers.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 812 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, these species are not established breeders in the study area and impacts would likely be limited to loss of migratory habitat. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo, and the effect of habitat loss on yellow warbler under Alternative 1A would not be adverse under NEPA. The yellow warbler is not a species that is covered under the BDCP and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. The Plan would remove 517 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 47 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 47 acres of valley/foothill riparian habitat should be restored/created and 47 acres should be protected to mitigate the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of tidal natural communities, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the Plan Area over the course of the BDCP), in order to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting yellow warblers to a less-than-significant impact, should they become established in the Plan Area. Considering the conservation actions described above, and AMM1–AMM7, AMM 22, and Mitigation Measure BIO-75, Alternative 1A over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 1A would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 812 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Therefore, there would be a time-lag before the restored habitat would benefit either species. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo under Alternative 1A would be less than significant. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect nesting yellow warblers, in order to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting yellow warblers, if present in the study area, to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.
- A qualified wildlife biologists with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to

construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors and species of special concern (except the Modesto song sparrow), and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.

- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting *pair* of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 1A would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 1A would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines*, would ensure that the transmission lines, poles, and towers are designed to avoid sensitive terrestrial habitats (including riparian) to the maximum extent feasible, which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of Plan Implementation on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler, and floodplain restoration has the potential to mobilize selenium and, therefore, to increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least Bell's vireo and yellow warbler.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least Bell's vireo and yellow warbler from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting yellow warblers.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury*

Management, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential effects of methylmercury on least Bell's vireo and yellow warbler.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on least Bell's vireo and yellow warbler with the implementation of *AMM2 Construction Best Management Practices and Monitoring*, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Sites-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-85 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 2. No adverse effects of increased inundation frequency on least Bell's vireo, yellow warbler, or their habitat would be expected, because riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in periodic inundation of up to 148 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 7. Inundation of restored floodplains would not be expected to affect least Bell's vireo, yellow warbler, or their habitat because the breeding period is outside the period when floodplains would likely be inundated. Additionally, periodic inundation of floodplains would be expected to restore a more natural flood regime in support of riparian vegetation types that support least Bell's vireo and yellow warbler habitat. The overall effect of seasonal inundation in existing riparian natural communities would be beneficial, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic inundation would not result in an adverse effect on least Bell's vireo or yellow warbler because inundation would occur primarily during the nonbreeding season and would promote a more natural flood regime in support of habitat for these species.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic inundation would have a less-than-significant impact on least Bell's vireo or yellow warbler because inundation would occur during the nonbreeding season and would not be expected to adversely modify habitat or result in direct mortality of either species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation in existing riparian natural communities would be beneficial for least Bell's vireo and yellow warbler.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 1A on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects for these species is based on primary breeding habitat and secondary habitat. Suisun song sparrow primary breeding habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the Plan Area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable forage. Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-1A-34. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the Suisun song sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3)
- Protect at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3)

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on Suisun song sparrow and saltmarsh common yellowthroat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-34. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	Primary	54	55	0	0	0	0
	Secondary	1,098	3,633	0	0	0	0
Total Impacts CM2–CM18		**1,152**	**3,688**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,152**	**3,688**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Alternative 1A conservation measures would result in the permanent loss of up to 3,688 acres of Suisun song sparrow and saltmarsh common yellowthroat habitat, which would include the conversion of 55 acres of primary habitat to secondary low marsh, and the conversion of 123 acres of secondary habitat to middle or high marsh (Table 12-1A-34). The only conservation measure that would affect modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would permanently remove approximately 3,510 acres of modeled secondary Suisun song sparrow and saltmarsh common yellowthroat habitat from CZ 11 (Table 12-1A-34). In addition, 55 acres of primary habitat would be converted to secondary low marsh, and 123 acres of secondary habitat would be converted to middle or high marsh. Most areas proposed for removal would be managed wetlands that serve as relatively marginal habitat for Suisun song sparrow and saltmarsh common yellowthroat, which primarily use brackish tidal wetlands. Approximately

2% of primary habitat for these species would be converted to foraging habitat. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland natural community in CZ 11, which would be expected to support Suisun song sparrow and saltmarsh common yellowthroat habitat. It is expected that restoring tidal wetland communities that are self-sustaining and not reliant on ongoing management actions necessary to maintain the existing managed wetland habitats would better ensure the long-term viability of these populations. Furthermore, effects of tidal habitat restoration on sparrow and yellowthroat abundance and distribution would be monitored, and the restoration of tidal habitat would be sequenced and located in a manner that minimizes effects on occupied habitats until functional habitats were restored (see BDCP Chapter 3, Section 3.4.5, *CM4 Tidal Natural Communities Restoration*, and Section 3.6, *Adaptive Management and Monitoring Program*).

- *CM11 Natural Communities Enhancement and Management:* Control of nonnative Suisun song sparrow and saltmarsh common yellowthroat predators, if deemed necessary, would be expected to reduce predation loss of nests and, consequently, increase and maintain the abundance of Suisun song sparrow and saltmarsh common yellowthroat in restored tidal habitats over the term of the BDCP. Habitat management- and enhancement-related activities could disturb Suisun song sparrow or saltmarsh common yellowthroat nests if they are located near work sites. The potential for these activities to have an adverse effect on Suisun song sparrow would be avoided and minimized through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. A variety of *CM11 Natural Communities Enhancement and Management* habitat management actions that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of Suisun song sparrow and saltmarsh common yellowthroat habitat in CZ 11. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available species' habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect Suisun song sparrow and saltmarsh common yellowthroat use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Construction-related activities could result in nest destruction or disturbance resulting in mortality of eggs and nestlings if restoration activities took place within the nesting period for these species. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize these effects on Suisun song sparrow. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. Grading, filling, contouring, and other initial ground-disturbing operations during restoration activities could temporarily fragment existing modeled tidal brackish emergent wetland habitat for Suisun song sparrow and saltmarsh common yellowthroat which could temporarily reduce the extent and functions of the affected habitat. These temporary effects would be minimized through sequencing of restoration activities and through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Under Alternative 1A, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,097 acres of tidal brackish emergent wetland should be restored/created to compensate for the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the Plan Area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22*

Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the effect of construction activities on nesting saltmarsh common yellowthroat.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1A as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of Suisun song sparrow and saltmarsh common yellowthroat habitat and potential direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and with the incorporation of the additional measures in the biological goals and objectives, and AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on Suisun song sparrow under Alternative 1A would not be adverse. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order for the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Under Alternative 1A, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,097 acres of tidal brackish emergent wetland should be restored/created to mitigate the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the Plan Area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential effect of construction activities on nesting saltmarsh common yellowthroat to less than significant.

Because the number of acres required to meet the typical mitigation ratio described above would be only 3,590 acres of restored/created tidal natural communities, the 6,000 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for Suisun song sparrow, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1A as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a covered species under the BDCP. Although preconstruction surveys for Suisun song sparrow may detect nesting saltmarsh common yellowthroat, for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting saltmarsh common yellowthroat to a less-than-significant level.

Considering these restoration provisions, which would replace low-value secondary habitat with high-value tidal brackish emergent habitat, including both foraging and primary habitat, and provide upland refugia for Suisun song sparrow and saltmarsh common yellowthroat, the acreages of restoration would be sufficient to compensate for habitats lost to construction and restoration activities. Loss of habitat or direct mortality through implementation of Alternative 1A, with the implementation of AMM1–AMM7, AMM22, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-81: Indirect Effects of Plan Implementation on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Indirect construction-related effects: If Suisun song sparrow or saltmarsh common yellowthroat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Suisun song sparrow and saltmarsh common yellowthroat habitat adjacent to restoration work areas could be affected by such disturbances, which could temporarily result in diminished use of habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect either species. If construction occurred during the nesting season, these indirect effects could result in the loss or abandonment of nests and mortality of any eggs and/or nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of Suisun song sparrow and saltmarsh common yellowthroat by requiring preconstruction surveys and, if nests are present, the establishment of a no-disturbance buffer within 250 feet of a nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Salinity: Water conveyance facilities operations would have an effect on salinity gradients in Suisun Marsh; however, these effects cannot be reasonably disaggregated from effects resulting from tidal habitat restoration. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water conveyance facilities operations and operations of salinity control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more saline environments, which should have a beneficial effect on Suisun song sparrow and saltmarsh common yellowthroat because their historical natural Suisun Marsh habitat is brackish tidal marsh. However, the degree to which salinity changes in all tidal channels and sloughs in and around Suisun Marsh would be highly variable.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Although tidal habitat restoration might increase methylation of mercury export to other habitats, restoration is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. Robinson et al. (2011) found toxic levels of methylmercury levels in song sparrow populations from southern San Francisco Bay, although populations near Suisun Marsh (i.e., San Pablo and Simas Creeks) were much lower. The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. The Suisun Marsh Plan anticipates that restored tidal wetlands would generate less methylmercury than the existing managed wetlands to be restored (Bureau of Reclamation et al. 2010).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Suisun song sparrow and saltmarsh common yellowthroat, and floodplain restoration has the potential to mobilize selenium and, therefore, to increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Suisun song sparrow and saltmarsh common yellowthroat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Suisun song sparrow and saltmarsh common yellowthroat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances would not have an adverse effect on Suisun song sparrow with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects of noise and visual disturbance on saltmarsh common yellowthroat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills, and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration would be expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration is unlikely to have a substantial impact on Suisun song sparrow and saltmarsh common yellowthroat through increased exposure to methylmercury, as these species currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*. Changes in salinity gradients would be expected to have a beneficial impact on Suisun song sparrow and saltmarsh common yellowthroat through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential increased selenium exposure would result in no adverse effect on these species.

The implementation of tidal natural communities restoration (CM4) is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. With these additional avoidance and minimization measures, Mitigation Measure BIO-75, and *CM12 Methylmercury Management*, indirect effects of Plan implementation would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the Plan Area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the Plan Area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the plan area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 1A would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-1A-35. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the Swainson's hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Conserve at least 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat (Objective SH1.1, associated with CM3).
- Protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Of the at least 42,275 acres of cultivated lands protected as Swainson's hawk foraging habitat under Objective SH1.2, up to 1,500 acres can occur in CZs 5 and 6, and must have land surface elevations greater than −1 foot NAVD88 (Objective SH1.3, associated with CM3).

- Protect at least 10,750 acres of grassland, vernal pool, and alkali seasonal wetland as Swainson's hawk foraging habitat (Objective SH1.4, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, and *AMM18 Swainson's Hawk,* impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-35. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	18	18	16	16	NA	NA
	Foraging	3,295	3,295	1,429	1,429	NA	NA
Total Impacts CM1		**3,313**	**3,313**	**1,445**	**1,445**	**NA**	**NA**
CM2–CM18	Nesting	252	412	54	85	41–70	189
	Foraging	8,903	48,511	504	1,540	3,025–6,635	8,008
Total Impacts CM2–CM18		**9,155**	**48,923**	**558**	**1,625**	**3,066–6,705**	**8,197**
Total Nesting		**270**	**430**	**70**	**101**	41–70	189
Total Foraging		**12,198**	**51,806**	**1,949**	**2,985**	3,025–6,635	8,008
TOTAL IMPACTS		**12,468**	**52,236**	**2,019**	**3,070**	**3,066–6,705**	**8,197**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 55,322 acres of modeled habitat (531 acres of nesting habitat and 54,791 acres of foraging habitat) for Swainson's hawk (Table 12-1A-35). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 34 acres of Swainson's hawk nesting habitat (18 acres of permanent loss and 16 acres of temporary loss). In addition, 4,740 acres of foraging habitat would be removed (3,295 acres of permanent loss, 1,445 acres of temporary loss). Activities that would impact modeled Swainson's hawk habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss would occur where Intakes 1–5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Temporary losses would occur where pipelines cross Snodgrass Slough and other small waterways east of the Sacramento River, and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are at least 17 occurrences of nesting Swainson's hawk that overlap with the construction footprint of CM1, primarily from the construction footprint of the permanent and temporary transmission lines, intake 5 and other intake work areas. The implementation of *AMM18 Swainson's Hawk*, would require preconstruction surveys and the establishment of no-disturbance buffers and would minimize potential effects on nesting Swainson's hawks present within or adjacent to construction areas. Permanent foraging habitat impacts from CM1 would include 914 acres of very high-value foraging habitat (alfalfa; Table 12-1A-36). Impacts from CM1 would occur in the central Delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1A-36. Acres of Impacted Swainson's Hawk Foraging Habitat by Value Classes

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	CM1 Permanent (temporary)	CM2–CM18 Permanent (temporary)
Very high	Alfalfa hay	914 (131)	13,898 (432)
Moderate	Irrigated pasture, other hay crops, tomatoes, grain crops (wheat, barley, oats), fallow fields	459 (393)	15,136 (477)
Low	Other irrigated field and truck crops, dry pasture, grasslands, alkali seasonal wetlands, vernal pool complex, sudan	735 (418)	10,535 (349)
Very low	Safflower, sunflower, corn, grain sorghum, managed wetlands	1,187 (488)	8,943 (281)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 133 acres of nesting habitat (79 acres of permanent loss, 54 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,500 acres of foraging habitat would be removed (996 acres of permanent loss, 554 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove Swainson's hawk habitat. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 295 acres of Swainson's hawk nesting habitat and 37,359 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. Impacts on foraging habitat from CM4 would consist of 10,757 acres of very high-value (alfalfa), 11,706 acres of moderate-value, and 7,973 acres of low-value habitat (See Table 12-1A-36 for land cover types classified by habitat value). Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. However, the conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM4, suggesting that numerous nest sites could be directly affected by inundation from tidal restoration activities.

- *CM5 Seasonally Inundated Floodplain Restoration* Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 69 acres of Swainson's hawk nesting habitat (38 acres of permanent loss, 31 acres of temporary loss) and 2,856 acres of foraging habitat (1,820 acres of permanent loss, 1,036 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 953 acres of Swainson's hawk foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of Swainson's hawk agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of Swainson's hawk foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 1,440 acres of Swainson's hawk foraging habitat in CZ 2 and CZ 4. Small patches of riparian vegetation that support Swainson's hawk nesting habitat may develop along the margins of restored nontidal marsh if appropriate site conditions are present.
- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of Swainson's hawk grassland foraging habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of Swainson's hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

Permanent and temporary nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk would be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* in addition to conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related

activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 340 acres (270 permanent, 70 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 34 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 14,147 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 4,740 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 34 acres of nesting habitat should be restored/created and 34 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 4,740 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (five gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk. Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With this program in place, Alternative 1A would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, Environmental Commitments, AMMs, and CMs, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 531 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and 54,791 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Communities Restoration, and CM8 Grassland Natural Communities Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1–4, 7–9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Swainson's hawk habitat and potential for direct mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18*

Swainson's Hawk, which would be in place during all project activities, the effects of habitat loss and potential mortality on Swainson's hawk under Alternative 1A would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. The Plan would remove 340 acres (270 permanent, 70 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 34 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 14,147 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 4,740 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 34 acres of nesting habitat should be restored/created and 34 acres should be protected to mitigate the CM1 losses of Swainson's hawk nesting habitat. In addition, 4,740 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller)

within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that are incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of removed known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.With this program in place, Alternative 1A would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 531 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and 54,791 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration,* and *CM8 Grassland Natural Communities Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian

restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1-4, 7- 9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk*, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Swainson's hawk.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. This species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the Plan Area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

NEPA Effects**:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion**:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of Plan Implementation on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. These construction activities would include water conveyance construction, tidal restoration activities, floodplain restoration, and Fremont Weir/Yolo Bypass Enhancements. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with BDCP actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

CEQA Conclusion: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 3,066–6,706 acres of modeled Swainson's hawk habitat (consisting of approximately 41–70 acres of nesting habitat and 3,025–6,635 acres of foraging habitat; Table 12-1A-34). However, project-associated inundation of areas that would not otherwise have been inundated would be expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the project-related inundation area already inundates in the bypass. Therefore, habitat conditions in the bypass would not be expected to change substantially as a result of Yolo Bypass operations. However, increased duration of inundation during years of Fremont Weir operation, may delay the period for which foraging habitat is available to Swainson's hawks by up to several weeks.

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 8,197 acres of modeled Swainson's hawk habitat (Table 12-1A-35), consisting of 189 acres of nesting and 8,008 acres of foraging habitat. Floodplain restoration would be expected to restore a more natural flood regime and sustain riparian vegetation types that support regeneration of Swainson's hawk nesting habitat. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years)

to areas that flood infrequently (e.g., every 10 years or more). Foraging habitat that is inundated after Swainson's hawks arrive in the Central Valley in mid-March could result in a periodic loss of available foraging habitat due to the reduction in available prey. Inundated habitats would be expected to recover following draw-down and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic and short term effect that is unlikely to affect Swainson's hawk distribution and abundance, or foraging use of the study area.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not have a significant impact on Swainson's hawk.

Tricolored Blackbird

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on tricolored blackbird. The habitat model used to assess effects for tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass and along the southwestern perimeter of the Plan Area, breeding colonies are uncommon in the Plan Area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the Plan Area. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the Plan Area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of tricolored blackbird modeled habitat as indicated in Table 12-1A-37. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the tricolored blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and manage at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11. (TRBL1.1).
- Protect at least 26,300 acres of moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, 50% of which is of high or very high value (TRBL1.2).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. At least 1,000 acres of which will be within 5 miles of the at least 50 acres of nesting habitat protected under Objective TRBL1.1 (Objective TRBL1.3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-37. Changes in Tricolored Blackbird Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]		Habitat Type	Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	Nesting	9	9	3	3	NA	NA
		Foraging - cultivated	695	695	344	344	NA	NA
		Foraging- noncultivated	214	214	186	186	NA	NA
	Nonbreeding	Roosting	23	23	9	9	NA	NA
		Foraging - cultivated	1,847	1,847	533	533	NA	NA
		Foraging - noncultivated	102	102	77	77	NA	NA
Total Impacts CM1								
CM2–CM18	Breeding	Nesting	13	72	75	77	11–26	30
		Foraging - cultivated	1,657	9,525	84	359	1,837–2,598	2,124
		Foraging noncultivated	704	1,991	155	184	600–1,689	355
	Nonbreeding	Roosting	570	1,642	0	1	0–4	29
		Foraging - cultivated	3,747	23,955	54	420	222–1,057	2,506
		Foraging - noncultivated	459	1,341	0	3	42–191	158
Total Impacts CM2–CM18			**7,150**	**38,566**	**368**	**1,044**	**2,711**	**5,766**
Total Breeding			**3,292**	**12,506**	**847**	**1,153**	**2,447–4,312**	**2,509**
Total Nonbreeding			**6,748**	**28,910**	**673**	**1,043**	**263–1,252**	**2,694**
TOTAL IMPACTS			**10,040**	**41,416**	**1,520**	**2,196**	**2,711**	**5,766**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 43,612 acres of modeled habitat (13,659 acres of breeding habitat and up to 29,953 acres of nonbreeding habitat) for tricolored blackbird (Table 12-1A-37). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of 918 acres of tricolored blackbird breeding habitat (9 acres nesting habitat, 695 acres of cultivated lands, and 214 acres of noncultivated lands suitable for foraging) and 1,972 acres of nonbreeding habitat (23 acres roosting habitat, 1,847 acres of cultivated lands, and 102 acres of noncultivated lands suitable for foraging (Table 12-1A-37). Approximately 831 of the acres permanently impacted would be lost as reusable tunnel material storage areas, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary.

  In addition, CM1 would result in the temporary removal of 533 acres of breeding habitat (3 acres nesting habitat, 344 acres of cultivated lands, and 186 acres of noncultivated lands suitable for foraging) and 619 acres of nonbreeding habitat (9 acres roosting habitat, 533 acres of cultivated lands, and 77 acres of noncultivated lands suitable for foraging, Table 12-1A-37).

  Most of the habitat that would be lost is located in the central Delta, from CZs 3-6 and CZ 8. There are no occurrences of tricolored blackbird that overlap with the construction footprint for CM1. However, records exist throughout the study area. The implementation of *AMM21 Tricolored Blackbird*, would require pre-construction surveys and the establishment of no-disturbance buffers and would minimize potential effects on nesting tricolored blackbirds (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Construction of CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would permanent loss of 595 acres of tricolored blackbird breeding habitat (13 acres nesting habitat, 477 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 8 acres of nonbreeding habitat (consisting entirely of roosting habitat). In addition, CM2 construction would result in the temporary removal of 314 acres of breeding habitat (75 acres nesting habitat, 84 acres of cultivated lands, and 155 acres of noncultivated lands suitable for foraging) and 54 acres of nonbreeding habitat (consisting entirely of cultivated lands). The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 3,937 acres of tricolored blackbird breeding habitat (21 acres of nesting, 2,814 acres of cultivated lands, and 1,102 acres of noncultivated lands suitable for foraging) and 10,794 acres of nonbreeding habitat (1,633 acres of roosting, 18,489 acres of cultivated lands, and 672 acres of noncultivated lands suitable for foraging). An estimated 13,692 acres of the 28,424 acres to be permanently lost would be expected to convert to tidal emergent wetland communities that could provide nonbreeding season roosting habitat for tricolored blackbirds, depending on future vegetation density and composition. Conversion would result in the loss of an estimated 4,316 acres of tricolored blackbird breeding habitat (34 acres of nesting habitat; plus 3,635 acres of cultivated lands and 647 acres of noncultivated habitats suitable for foraging) and 9,375 acres of nonbreeding habitat (8,716 acres of cultivated lands and 659 acres of noncultivated habitats suitable for foraging). These habitat losses and conversions would occur in CZs 1, 2, 4, 5, 6, 7, 8, and 11. Although considered to be a permanent loss, due to the uncertainty of the quantity of restored suitable habitat, any areas that develop into riparian scrub-shrub could provide suitable nesting and roosting habitat for tricolored blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction and riparian restoration associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent removal of up to 554 acres of tricolored blackbird breeding habitat (4 acres of nesting habitat, 503 acres of cultivated lands, and 47 acres of noncultivated habitats suitable for foraging) and 656 acres of nonbreeding habitat (1 acre of roosting habitat, 652 acres of cultivated lands, and 3 acres of noncultivated habitats suitable for foraging) in CZ 7. Patches of riparian scrub associated with the restoration of approximately 1,000 acres of valley/foothill riparian habitat managed as early- to mid-successional habitats (as a component of CM5) could provide suitable nesting, roosting or foraging habitat for tricolored blackbird once these restored habitats have developed habitat functions for the species.

- *CM8 Grassland Natural Communities Restoration*: Restoration of grassland would result in the permanent removal of 1,521 acres of tricolored breeding habitat and 210 acres of nonbreeding habitat. Grassland restoration would be implemented on cultivated lands and would therefore result in the conversion of tricolored blackbird cultivated foraging habitat to high-value grassland foraging habitat in CZs 2, 4, and 5.

- *CM10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 568 acres of tricolored blackbird breeding habitat and 945 acres of nonbreeding habitat (all cultivated lands suitable for foraging). About two-thirds of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide low-value roosting habitat for tricolored blackbird depending on vegetation density and composition.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 43.5 acres of breeding habitat and 6.5 acres of nonbreeding habitat (all grassland suitable for foraging) would be lost as a result of construction of trails and facilities. Impacts from recreational-related facilities that would occur within the first 10 years of Plan implementation would include a loss of 13 acres of breeding habitat.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of tricolored blackbird grassland foraging habitat in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 250 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 4,139 acres of breeding habitat (100 acres of nesting, 1,207 acres of cultivated lands, and 1,259 acres of noncultivated lands suitable for foraging) and 7,421 acres of nonbreeding habitat (602 acres of roosting, 4,867 acres of cultivated lands, and 638 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,451 acres of breeding, 2,591 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 12 acres of restoration and 12 acres of protection of nesting habitat, 32 acres of restoration and 32 acres of protection of roosting habitat, 1,158 acres of protection of noncultivated lands that provide foraging habitat, 1,039 acres of protection of cultivated lands suitable for foraging during the breeding season, and 1,066 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season. using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 100 acres of restoration and 100 acres of protection for nesting habitat, 602 acres of restoration and 602 acres of protection for roosting habitat, 2,277 acres of protection of noncultivated foraging habitat, 2,780 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 4,867 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1A-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, Environmental Commitments, AMMs, and CMs, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in an adverse effect on tricolored blackbird.

Table 12-1A-38. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies	Corn, sunflower, millet, alfalfa and mixed alfalfa, mixed pasture, native pasture, induced high water table native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grass pasture, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots, organic rice	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Mixed grain and hay crops, farmsteads, non-irrigated mixed grain and hay, rice	Wheat, oats, mixed grain and hay, farmsteads, unirrigated mixed grain and hay, and non-irrigated misc. grain and hay

[a] Generally March through August; occasional breeding in fall (September through November).

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP Chapter 5, *Effects Analysis*). Alternative 1A as a whole would result in the permanent loss of and temporary effects on 13,659 acres of breeding habitat and 29,953 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (8% of the total breeding habitat in the study area and 8% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Communities Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). In addition,

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1A-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6.12.2) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The losses of tricolored blackbird habitat and potential for direct mortality of a special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM5, CM7, CM8, and CM11, guided by species-specific goals and objectives, and by AMM1–AMM7 and *AMM21 Tricolored Blackbird*, which would be in place during all project activities, the effects of habitat loss and potential mortality on tricolored blackbird would not be adverse under Alternative 1A.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 4,139 acres of breeding habitat (100 acres of nesting, 1,207 acres of cultivated lands, and 1,259 acres of noncultivated lands suitable for foraging) and 7,421 acres of nonbreeding habitat (602 acres of roosting, 4,867 acres of cultivated lands, and 638 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,451 acres of breeding, 2,591 acres of nonbreeding habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain*

Restoration, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding habitat).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 12 acres of restoration and 12 acres of protection of nesting habitat, 32 acres of restoration and 32 acres of protection of roosting habitat, 1,158 acres of protection of noncultivated lands that provide foraging habitat, 1,039 acres of protection of cultivated lands suitable for foraging during the breeding season, and 1,066 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season. using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 100 acres of restoration and 100 acres of protection for nesting habitat, 602 acres of restoration and 602 acres of protection for roosting habitat, 2,277 acres of protection of noncultivated foraging habitat, 2,780 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 4,867 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1A-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction under *AMM2 Construction Best Management Practices and Monitoring*). With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in a significant impact on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP Chapter 5, *Effects Analysis*). Alternative 1A as a whole would result in the permanent loss of and temporary effects on 13,659 acres of breeding habitat and 29,953 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (8% of the total breeding habitat in the study area and 8% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). In addition, Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1A-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6.12.2) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres of breeding habitat and 31,090 acres of nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres of breeding habitat and 28,811 acres of nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 1A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area. Although migratory movements and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission*

Lines). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the Plan Area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is minimal.

NEPA Effects: New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane*contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is considered minimal. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on tricolored blackbird.

CEQA Conclusion: New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is considered minimal. The construction and operation of new transmission lines under Alternative 1A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of Plan Implementation on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1.900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 250 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony or roost site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury.

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. Furthermore, the Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands, potentially reducing the overall risk. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community and floodplain restoration could indirectly affect tricolored blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants* of the BDCP).

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1–7, AMM21, AMM27, and CM12 in place, the indirect effects of Alternative 1A implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 2,447–4,312 acres of breeding habitat and 263–1,252 acres of nonbreeding habitat (Table 12-1A-37). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 2,509 acres of breeding habitat (30 acres of nesting, 2,124 acres of cultivated lands, 355 acres of noncultivated lands suitable for foraging) and 2,694 acres of nonbreeding habitat (29 acres of roosting, 2,506 acres of cultivated lands, 158 acres of noncultivated lands suitable for foraging, Table 12-1A-37) resulting in the temporary loss of these habitats. Tricolored blackbirds are highly nomadic during the winter and would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat. There would be no expected adverse effect on tricolored blackbird.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would not result in an adverse effect on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would have a less-than-significant impact on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

Western Burrowing Owl

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-1A-39. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the western burrowing owl (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 1,000 acres of cultivated lands in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 mile of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1, associated with CM3).
- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands and vernal pool complex in CZs 1, 8, and/or 11 to achieve no net loss of wetted acres (Objectives ASWNC1.2 and VPNC1.2, associated with CM9)

- Increase burrow availability and prey abundance and accessibility (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, VPNC2.5, GNC2.3, and GNC2.4, associated with CM11)
- Protect at least 48,600 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species and maintain and protect the small patches of important wildlife habitats associated with cultivated lands (Objectives CLNC1.1 and CLNC1.3, associated with CM3)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activates that would enhance habitat for the species and implementation of AMM1–AMM7 and *AMM23 Western Burrowing Ow*l, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-39. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	499	499	460	460	NA	NA
	Low-value	2,478	2,478	766	766	NA	NA
Total Impacts CM1		**2,977**	**2,977**	**1,226**	**1,226**	**NA**	**NA**
CM2–CM18	High-value	4,487	11,570	245	328	1,390–3,303	779
	Low-value	3,527	28,506	144	971	1,522–2,927	6,162
Total Impacts CM2–CM18		**8,014**	**40,076**	**389**	**1,299**	**2,912–6,230**	**6,941**
Total High-value		**4,986**	**12,069**	**705**	**788**	**1,390–3,303**	**779**
Total Low-value		**6,005**	**30,984**	**910**	**1,737**	**1,522–2,927**	**6,162**
TOTAL IMPACTS		**10,991**	**43,053**	**1,615**	**2,525**	**2,912–6,230**	**6,941**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 45,578 acres of modeled habitat for western burrowing owl (of which 12,857 acres is of high-value and 32,721 acres is of low-value, Table 12-1A-39). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural*

Communities Restoration, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*. The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 959 acres of acres of modeled high-value western burrowing owl habitat (499 acres of permanent loss, 460 acres of temporary loss) from CZs 3–6 and CZ 8. In addition, 3,244 acres of low-value burrowing owl habitat would be removed (2,478 acres of permanent loss, 766 acres of temporary loss) from CZs 3–6 and CZ 8. The majority of high-value grassland that would be removed would be in CZ 8, from the construction of the new forebay in CZ 8. The footprint for CM1 does not overlap with any occurrences of western burrowing owl. However, there is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from facility construction and the establishment of the forebay borrow and spoils area could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat. The implementation of *AMM23 Western Burrowing Owl* would minimize effects on western burrowing owl if they were present in the construction area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts resulting from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,127 acres of high-value western burrowing owl habitat (882 acres of permanent loss, 245 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 242 acres of low-value habitat would be removed (98 acres of permanent loss, 144 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 29,668 acres of modeled western burrowing owl habitat in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. The majority of removed or converted acres (19,739 acres) is composed of low-value habitat. However, 9,929 acres of high-value habitat would also be lost from tidal restoration actions. Tidal restoration would directly impact and fragment remaining high-value grassland habitat just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Tidal natural community restoration efforts would impact one extant record of burrowing owl just northeast of Oakley along Dutch Slough and one possibly extirpated record in Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,504 acres of modeled western burrowing owl in CZs 2, 4, and 7. This total is comprised of 2,279 acres of low-value habitat. Also, 225 acres of high-value grassland habitat would be removed (142 permanent, 83 temporary) consisting of small patches of habitat along the San Joaquin, Old, and Middle Rivers in CZ 7.

- *CM6 Channel Margin Enhancement*: Sites for channel margin enhancement would be located along levees where western burrowing owl could be present. The species is known to use often the grassland edges along canals and levees in agricultural areas. The implementation of *AMM23 Western Burrowing Owl* would reduce the potential for channel margin enhancement activities to disturb owls or affect active nests.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 11 acres of high-value burrowing owl habitat as part of tidal restoration. In addition, 960 acres of low-value habitat would be removed as a part of tidal restoration and 3,991 acres would be removed as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would primarily be implemented on agricultural lands and would result in the permanent loss of 1,676 acres (362 acres of high-value and 1,314 acres of low-value) of western burrowing owl habitat. The conversion of 1,676 acres of low-value habitat to high-value grassland, would temporarily remove available habitat but would ultimately have a beneficial effect on the western burrowing owl.
- *CM10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 159 acres of high-value and 952 acres of low-value western burrowing owl habitat.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activates and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* into the BDCP which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value western burrowing owl habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat.

Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,691 acres (4,986 acres permanent, 705 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 959 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 6,915 acres of low-value habitat would be removed or converted in the near-term (CM1, 3,244 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 1,918 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 3,244 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the plan area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11. (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on western burrowing owl habitat. Some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include high-value crop types. These acres, in addition to the management and enhancement activities that are contained in the Plan goals, would satisfy the typical mitigation ratios that would be applied to the other near-term conservation actions, providing that the 15,400 acres of cultivated lands protected in the near-term were managed in suitable crop types to compensate for the loss of high-value habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, would be available to address the potential effect of high-value habitat loss in the near-term. The acres of protection of cultivated lands would be sufficient to compensate for the loss of low-value burrowing owl habitat from CM1 and from the other near-term conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 12,857 acres of high-value habitat and

32,721 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11. (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres of high-value and 25,177 acres of low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres of high-value and 3 acres of low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of western burrowing owl habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM23 Western Burrowing Owl,* and with the implementation of Mitigation Measure BIO-91, *Compensate For the Near-Term Loss of High-Value Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl would not be adverse under Alternative 1A.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 5,691 acres (4,986 acres permanent, 705 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 959 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 6,915 acres of low-value habitat would be removed or converted in the near-term (CM1, 3,244 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 2,464 acres should be protected to mitigate the loss of high-value habitat from CM1 and that 3,702 acres should be protected to mitigate the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to mitigate the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the plan area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on western burrowing owl habitat. Some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include high-value crop types. These acres, in addition to the management and enhancement activities that are contained in the Plan goals, would satisfy the typical mitigation ratios that would be applied to the other near-term conservation actions, providing that the 15,400 acres of cultivated lands protected in the near-term were managed in suitable crop types to compensate for the loss of high-value habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, would reduce the impact of high-value habitat loss in the near-term. The acres of protection of cultivated lands would be sufficient to compensate for the loss of low-value burrowing owl habitat from CM1 and from the other near-term conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 12,857 acres of high-value habitat and 32,721 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat.)

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, Environmental Commitments, AMMs, and CMs, of the Final EIR/EIS.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, *AMM23 Western Burrowing Owl,* and Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western burrowing owl.

Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

Because the BDCP lacks acreage commitment for crop types that would be protected and managed within the 15,400 acres of cultivated lands protected in the near-term time period, DWR will compensate for the loss of high-value burrowing owl habitat with high-value natural communities or cultivated crop types a ratio of 2:1 in the near-term time period.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given the species' physical and behavioral characteristics (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). New transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of Plan Implementation on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of modeled habitat adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January

31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with the implementation of *AMM23 Western Burrowing Owl* into the BDCP, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

***NEPA Effects*: ** Indirect effects on western burrowing owl as a result of Alternative 1A implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 1A implementation would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects on western burrowing owl as a result of Alternative 1A implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 1A implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,195–3,004 acres of high-value habitat and 1,522–2,927 acres of low-value habitat (Table 12-1A-39).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 6,941 acres of modeled habitat (6,162 acres of which would be low-value foraging habitat; Table 12-1A-39).

Burrowing owls cannot use inundated areas for foraging or nesting, and increased inundation frequency and duration of cultivated lands and grassland habitats may affect prey populations that have insufficient time to recover following inundation events. Depending on timing, seasonal inundation of western burrowing owl habitat could result in displacement from nesting burrows or drowning of individuals. The potential for this effect is considered low because suitable burrow sites would most likely be located along setback levees, which are expected to be subject to inundation less frequently than floodplain surfaces that would be less likely to support suitable nesting burrows. The periodically inundated habitat would not be expected to have an adverse effect on the population.

NEPA Effects: The periodically inundated habitat would not be expected to have an adverse effect on the population. The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation; therefore, the potential effect would not be adverse.

CEQA Conclusion: The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation. Therefore, periodic inundation would be expected to have a less-than-significant impact on the population.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on western yellow-billed cuckoo. The habitat model for western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres. Modeled habitat also includes migratory habitat, which contains the same plant alliances as breeding habitat but without the minimum 50-acre patch size requirement.

The western yellow-billed cuckoo is uncommon in the Plan Area at present, and the likelihood that it will be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the plan area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of western yellow-billed cuckoo modeled habitat as indicated in Table 12-1A-40. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the western yellow-billed cuckoo (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on Western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-40. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	0	0	0	0	NA	NA
	Migratory	23	23	14	14	NA	NA
Total Impacts CM1		**23**	**23**	**14**	**14**	**NA**	**NA**
CM2–CM18	Breeding	29	142	5	10	11–20	17
	Migratory	278	383	83	94	37–64	125
Total Impacts CM2–CM18		**307**	**525**	**88**	**104**	**48–84**	**142**
Total Breeding		**29**	**142**	**5**	**10**	**11–20**	**17**
Total Migratory		**301**	**406**	**97**	**108**	**37–64**	**125**
TOTAL IMPACTS		**330**	**548**	**102**	**118**	**48–84**	**142**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 666 acres of modeled habitat for western yellow-billed cuckoo (152 acres of breeding habitat, 514 acres of migratory habitat, Table 12-1A-40). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 37 acres of modeled western yellow-billed cuckoo migratory habitat (Table 12-1A-40). No modeled breeding habitat would be impacted by CM1. Of the 37 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 23 acres would be a permanent loss and 14 acres would be a temporary loss of migratory habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Impacts from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. There are no extant occurrences of yellow-billed cuckoo nests in the study area. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the loss of approximately 31 acres of breeding habitat (26 acres of permanent loss and 5 acres of temporary loss) and 140 acres of migratory habitat (57 acres of permanent loss and 83 acres of temporary loss) for yellow-billed cuckoo in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1A implementation. There are no extant occurrences of yellow-billed cuckoo nesting in the study area.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 110 acres of modeled yellow-billed cuckoo breeding habitat and 310 acres of modeled migratory habitat in CZ 1, 2, 6, and 11. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove. These detections do not overlap with the hypothetical restoration areas for CM4.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 11 acres of modeled yellow-billed cuckoo breeding habitat (6 acres of permanent loss and 5 acres of temporary loss) and 27 acres of migratory habitat (16 acres of permanent loss and 11 acres of temporary loss) in CZ 7. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support western yellow-billed cuckoo habitat once the riparian vegetation has developed habitat functions for the cuckoo.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat over the term of the BDCP. With conditions favorable for its future establishment in the Plan Area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. *CM11 Natural Communities Enhancement and Management* actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values over the term of the BDCP.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection in 2009 in DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the present of suitable habitat indicates that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 432 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 37 acres of modeled migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 37 acres of valley/foothill riparian habitat should be restored/created and 37 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs,* of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 666 acres of modeled habitat (5% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat associated with Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, the species is not an established breeder in the study area and current presence is limited to migrants. In addition, the habitat lost would consist of small, fragmented riparian stands that would not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and

CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on western yellow-billed cuckoo would not be adverse under Alternative 1A.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 432 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 37 acres of modeled migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 37 acres of valley/foothill riparian habitat should be restored/created and 37 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

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The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

*Countermeasure Pla*n, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on Western yellow-billed cuckoo from Alternative 1A would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species; however, considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a, minimal effect on the species.

NEPA Effects: Fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area, it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors, which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. Because there is low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

NEPA Effects: The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of Plan Implementation on Western Yellow-Billed Cuckoo

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: Western yellow-billed cuckoo modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Cuckoos are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on western yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the western yellow-billed cuckoo. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on western yellow-billed cuckoo.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on western yellow-billed cuckoo from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Alternative 1A implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Indirect effects on western yellow-billed cuckoo as a result of Alternative 1A implementation could have a significant impact on the species from modification of habitat.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects as a result of Alternative 1A implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 11-20 acres of modeled western yellow-billed cuckoo breeding habitat and 37–64 acres of modeled migratory habitat. No adverse effects of increased inundation frequency on western yellow-billed cuckoo or its habitat are expected because the cuckoo breeding period is outside the period the weir would be operated. In addition, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 142 acres of modeled western yellow-billed cuckoo habitat (17 acres of breeding habitat, 125 acres of migratory habitat). Inundation of restored floodplains is not expected to affect western yellow-billed cuckoo or its habitat adversely because the cuckoo breeding period is outside the period the floodplains would likely be inundated, and periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for western yellow-billed cuckoo. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for western yellow-billed cuckoo, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Periodic effects of inundation would not have an adverse on yellow-billed cuckoo if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

White-Tailed Kite

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen 1995).

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-1A-41. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed*

Kite, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1A would also include the following biological objectives over the term of the BDCP to benefit the white-tailed kite (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM11)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-41. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	29	29	20	20	NA	NA
	Foraging	3,299	3,299	1,432	1,432	NA	NA
Total Impacts CM1		**3,328**	**3,328**	**1,452**	**1,452**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
	Foraging	8,723	52,675	516	1,484	3,030–6,651	7,402
Total Impacts CM2–CM18		**9,035**	**53,182**	**604**	**1,605**	**3,078–6,733**	**7,632**
Total Nesting		**341**	**536**	**108**	**141**	**48–82**	**230**
Total Foraging		**12,022**	**55,974**	**1,948**	**2,916**	**3,030–6,651**	**7,402**
TOTAL IMPACTS		**12,363**	**56,510**	**2,056**	**3,057**	**3,078–6,733**	**7,632**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 59,567 acres of modeled habitat (677 acres of nesting habitat and 58,890 acres of foraging habitat) for white-tailed kite (Table 12-1A-41). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 49 acres of white-tailed kite nesting habitat (29 acres of permanent loss and 20 acres of temporary loss). In addition, 4,731 acres of foraging habitat would be removed (3,299 acres of permanent loss, 1,432 acres of temporary loss). (Table 12-1A-41). Activities that would impact modeled White-tailed kite habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Temporary losses of nesting habitat would occur where pipelines cross Snodgrass Slough and other small waterways east of the Sacramento River, and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no occurrences of nesting white-tailed kite that overlap with the construction footprint of CM1. However, the implementation of *AMM39 White-Tailed Kite* would minimize effects on white-tailed kites if they were to nest within or adjacent to the construction footprint. Impacts on white-tailed kite foraging habitat would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,525 acres of foraging habitat would be removed (1,008 acres of permanent loss, 516 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove white-tailed kite habitat. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 383 acres of white-tailed kite nesting habitat and 41,625 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of white-tailed kite nesting habitat (42 acres of permanent loss, 33 acres of temporary loss) and 2,675 acres of foraging habitat (1,706 acres of permanent loss, 968 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 971 acres of white-tailed kite foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of white-tailed kite agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value.
- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 1,440 acres of cultivated lands to nontidal marsh in CZ 2 and CZ 4. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.
- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of white-tailed kite grassland foraging habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-white-tailed kite foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

Permanent and temporary white-tailed kite nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM39 White-Tailed Kite* in addition to conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged white-tailed kite if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM39 White-Tailed Kite* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 14,873 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 5,634 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 5,634 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.With this program in place, Alternative 1A would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 59,793 acres of foraging habitat (12% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite habitat and potential for direct mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM39 White-Tailed Kite*, which would be in place during all project activities, the effects of habitat loss and potential mortality on white-tailed kite under Alternative 1A would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 14,873 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 5,634 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 5,634 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and

other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With this program in place, Alternative 1A would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 59,793 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain*

Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on white-tailed kite habitat from Alterative 1A would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite*, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. In particular, 95% of the loss of foraging habitat effects involve the conversion from one habitat type to another form of suitable foraging habitat. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on white-tailed kite.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite is at low risk of bird strike mortality from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on white-tailed kite.

CEQA Conclusion: The construction and presence of new transmission lines would not represent a significant impact because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of Plan Implementation on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM39 White-Tailed Kite* would require preconstruction surveys, and if detected, 200 yard no disturbance buffers would be established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on white-tailed kite.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect white-tailed kite use of the surrounding habitat. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1A would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1A implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1A would have a less-than-significant impact on white-tailed kite with the implementation of *AMM39 White-Tailed Kite*, and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1A implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations related to *CM2 Yolo Bypass Fisheries Enhancement* would increase the frequency and duration of inundation on approximately 48–82 acres of modeled white-tailed kite nesting habitat and 3,030–6,651 acres of modeled white-tailed kite foraging habitat (Table 12-1A-41). During inundation years, affected cultivated lands and grassland would not be available as foraging habitat until prey populations have re-inhabited inundated areas. This would result in temporary periodic reduction in availability of foraging habitat. If late-season Fremont Weir operations were to preclude the planting of some crop types, there could be a further loss of foraging habitat value if the crop type that would have been planted would provide greater foraging habitat value than the fallowed fields. No known white-tailed kite nest sites would be affected, and increased periodic flooding is not expected to cause any adverse effect on nest sites that may be within the inundation area because existing trees already withstand floods in the area, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and any nest sites would be located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to approximately 230 acres of modeled white-tailed kite nesting habitat and 7,402 acres of modeled white-tailed kite foraging habitat (Table 12-1A-41). Inundation of foraging habitat could result in a periodic reduction of available foraging habitat due to the reduction in available prey. Following draw-down, inundated habitats are expected to recover and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic impact that is unlikely to affect white-tailed kite distribution and abundance, or foraging use of the Plan Area.

Periodic inundation of floodplains (through CM2 and CM5) would be expected to restore a more natural flood regime in support of riparian vegetation types that support white-tailed kite nesting habitat. No adverse effects of inundation on white-tailed kite riparian habitat are expected because valley/foothill riparian vegetation is expected to benefit from seasonal inundation.

***NEPA Effects*:** Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would not result in an adverse effect.

***CEQA Conclusion*:** Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would be expected to have a less-than-significant impact on white-tailed kite.

Yellow-Breasted Chat

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking. For this reason, the effects analysis only provides the breakdown between primary and secondary habitat in the habitat loss totals and associated tables, and does not provide this breakdown in the text by activity or effect type.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-1A-42. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit the yellow-breasted chat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in C Z7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-42. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Nesting and Migratory Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	20	20	5	5	NA	NA
	Secondary	10	10	12	12	NA	NA
	Suisun Marsh/ Upper Yolo Bypass	0	0	0	0	NA	NA
Total Impacts CM1		**30**	**30**	**17**	**17**	**NA**	**NA**
CM2–CM18	Primary	96	214	58	73	19–38	92
	Secondary	209	357	0	6	6–18	56
	Suisun Marsh/ Upper Yolo Bypass	76	85	29	29	23–32	0
Total Impacts CM2–CM18		**381**	**656**	**87**	**108**	**48–88**	**148**
Total Primary		**116**	**234**	**63**	**78**	**19–38**	**92**
Total Secondary		**219**	**367**	**12**	**18**	**6–18**	**56**
Total Suisun Marsh/Upper Yolo Bypass		**76**	**85**	**29**	**29**	**23–32**	**0**
TOTAL IMPACTS		**411**	**686**	**104**	**125**	**48–88**	**148**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 811 acres of modeled nesting and migratory habitat for yellow-breasted chat (686 acres of permanent loss, 125 acres of temporary loss, Table 12-1A-42). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 25 acres of primary habitat (20 acres of permanent loss, 5 acres of temporary loss). In addition, 22 acres of secondary habitat would be removed (10 acres of permanent loss, 12 acres of temporary loss), (Table 12-1A-42). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Impacts from CM1 would occur in the central delta in CZs 3- 6, and 8. This loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for resting, protection, or foraging. There are no occurrences of yellow-breasted chat that overlap with the CM1 construction footprint. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize effects on yellow-breasted chat if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction would permanently remove approximately 83 acres and temporarily remove 88 acres of yellow-breasted chat habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1A implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled yellow-breasted chat habitat in CZ 1, 2, 6, and 11. This total is composed of an estimated 182 acres of primary nesting and migratory habitat, 349 acres of secondary nesting and migratory habitat, and 14 acres of nesting and migratory habitat in the Suisun Marsh and upper Yolo Bypass areas.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 49 acres of modeled yellow-breasted chat habitat in CZ 7. This total is comprised of 28 acres of primary nesting and migratory habitat and 21 acres of secondary nesting and migratory habitat. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support yellow-breasted chat habitat.
- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat over the term of the BDCP. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the Plan Area.

  Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-*

Billed Cuckoo would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.
- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 515 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 47 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 47 acres of valley/foothill riparian habitat should be restored/created and 47 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have an adverse population-level effect on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22*

Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 811 acres of modeled habitat (6% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-breasted chat habitat and potential direct mortality of this special-status species would represent an adverse effect in the absence of other conservation actions. It would take 5 years to several decades for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the nesting and migratory habitat that would be lost is small relative to the species' range throughout California and North America, and because the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species, BDCP actions would not be expected to have an adverse population-level effect on the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on yellow-breasted chat under Alternative 1A would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impact of construction would be less than significant under CEQA. The Plan would remove 515 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 47 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 47 acres of valley/foothill riparian habitat should be restored/created and 47 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have a significant population-level impact on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 811 acres of modeled habitat (6% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge* Operations Plan, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-breasted chat habitat from Alternative 1A would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on western yellow-breasted chat.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Because of the current infrequent occurrence and small numbers of yellow-breasted chat in the Plan Area, and because CM5 would restore and protect contiguous high-value riparian habitat in CZ 7, any such habitat fragmentation is expected to have no or minimal effect on the species.

NEPA Effects: Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions would be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the study area during the summer, when visibility is high. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird-strike is considered to be minimal based on the species' small, relatively maneuverable body, its foraging behavior, and its presence in the Plan Area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of Plan Implementation on Yellow-Breasted Chat

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's*

Vireo, Western Yellow-Billed Cuckoo into the BDCP, which would ensure 250-foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize this effect on the species.

Methylmercury Exposure: Yellow-breasted chat modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Yellow-breasted chats are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the yellow-breasted chat. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-breasted chat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-breasted chat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP.

CEQA Conclusion: Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–88 acres of modeled yellow-breasted chat nesting and migratory habitat. No adverse effects of increased inundation frequency on yellow-breasted chat or its habitat are expected because the chat breeding period is outside the period the weir would be operated. Moreover, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 could result in periodic inundation of up to 148 acres of modeled yellow-breasted chat habitat. Inundation of restored floodplains is not expected to affect yellow-breasted chat or its habitat because the chat breeding period is outside the period the floodplains would likely be inundated. In addition, providing for periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for yellow-breasted chat. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increases in the frequency and duration of Yolo Bypass flooding and CM5 floodplain restoration would be expected to create more natural flood regimes that would support riparian habitat, which would not result in an adverse effect on yellow breasted chat.

CEQA Conclusion: Periodic inundation would have a less-than-significant impact on yellow-breasted chat because inundation would occur outside of the breeding season and would not be expected to adversely modify habitat or result in direct mortality of the species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation would be beneficial for yellow-breasted chat.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled nesting habitat for these species is restricted to valley/foothill riparian forest.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-1A-43. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP which would also benefit Cooper's hawk and osprey (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the acres of restoration or protection included in the Plan, in addition to management activities to enhance natural communities for species and the implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-43. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	29	29	20	20	NA	NA
Total Impacts CM1		**29**	**29**	**20**	**20**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
Total Impacts CM2–CM18		**312**	**507**	**88**	**121**	**48–82**	**230**
TOTAL IMPACTS		**341**	**536**	**108**	**141**	**48–82**	**230**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 677 acres of modeled nesting habitat (536 acres of permanent loss, 141 acres of temporary loss) habitat for Cooper's hawk and osprey (Table 12-1A-43). Conservation measures that would result in these losses are Water Facilities and Operation (CM1) (which would involve construction of conveyance facilities and transmission lines and establishment and use of borrow and spoil areas), Yolo Bypass Fisheries Enhancement (CM2), Tidal Natural Communities Restoration (CM4), and Seasonally Inundated Floodplain Restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 49 acres of modeled Cooper's hawk and osprey habitat (Table 12-1A-43). Of the 49 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 29 acres would be a permanent loss and 20 acres would be a temporary loss of habitat. This loss would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Impacts resulting from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require pre-construction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on cooper's hawk and osprey if either species were to nest in or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of Cooper's hawk and osprey nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential Cooper's hawk and osprey habitat. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration could permanently remove up to 383 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of Cooper's hawk and osprey nesting habitat (42 acres of permanent loss, 33 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7. CM11 Natural Communities Enhancement and Management: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in CM11 Natural Communities Enhancement and Management that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these potential effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo*

Bypass Fisheries Enhancement, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, The near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure

BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

NEPA Effects: The loss of Cooper's hawk and osprey habitat and potential for direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place during all project activities, the effects of habitat loss on Cooper's hawk and osprey under Alternative 1A would not be adverse. Cooper's hawk and osprey are not covered species under the BDCP and, in order for the BDCP not to have an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to mitigate the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, The near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios. The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and

other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting Cooper's hawk and osprey to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and

Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of Plan Implementation on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring,* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailablity resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cooper's hawk and osprey.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey, and floodplain restoration has the potential to mobilize selenium and, therefore, to increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Cooper's hawk and osprey.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Cooper's hawk and osprey from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on cooper's hawk and osprey. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Cooper's hawk and osprey, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1A would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury through the ingestion of fish or small mammals in restored tidal areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would address the uncertainty of methylmercury levels in restored tidal marsh in the study area and better inform potential impacts on Cooper's hawk and osprey. Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, the impact of potential increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-82 acres of modeled Cooper's hawk and osprey breeding habitat However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 230 acres of breeding habitat for Cooper's hawk and osprey. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation resulting from CM2 and CM5 would not have an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation resulting from CM2 and CM5 would have a less-than-significant impact on Cooper's hawk and osprey.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-1A-44. Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP that would also benefit golden eagles or ferruginous hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-44. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	1,660	1,660	673	673	NA	NA
Total Impacts CM1		**1,660**	**1,660**	**673**	**673**	**NA**	**NA**
CM2–CM18	Foraging	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**7,110**	**27,858**	**1,049**	**1,566**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 29,424 acres of modeled foraging habitat for golden eagle and ferruginous hawk (27,858 acres of permanent loss and 1,566 acres of temporary loss, Table 12-1A-44). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 2,333 acres of modeled golden eagle and ferruginous hawk foraging habitat (1,660 acres of permanent loss, 673 acres of temporary loss) from CZs 3-6 and CZ 8. The majority of habitat that would be removed would be in CZ 8, from the construction of the new forebay (685 acres) and the four proposed Reusable Tunnel Material storage areas in the central Delta (on Victoria Island, Bacon Island, Tyler Island,

and Andrus Island) that are each approximately 288-572 acres. The potential borrow spoil site southwest of the proposed forebay would also temporarily remove golden eagle and ferruginous hawk foraging habitat. The CM1 construction footprint does not overlap with any occurrences of golden eagle or ferruginous hawk. However, some of the grassland habitat lost in CZ 8 is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which provides high-value foraging habitat for these species. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled golden eagle and ferruginous hawk foraging habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1A implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled golden eagle and ferruginous hawk foraging habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide foraging habitat for golden eagle and ferruginous hawk and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of golden eagle and ferruginous hawk foraging habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance

activities, would be expected to have minor adverse effects on available habitat for these species. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled golden eagle and ferruginous hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4

in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11. (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson’s hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat,* would be available to address the effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,424 acres of modeled foraging habitat during the term of the Plan (11% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration, and CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under CM11 Natural Communities Enhancement and Management, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of golden eagle and ferruginous hawk habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the effects of habitat loss and potential direct mortality on golden eagle and ferruginous hawk under Alternative 1A would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. The implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous*

Hawk Foraging Habitat, would reduce the effect of habitat loss in the near-term to less than significant.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,424 acres of modeled foraging habitat during the term of the Plan (11% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on golden eagle and ferruginous hawk foraging habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species; however, considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat,* the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on golden eagle and ferruginous hawk.

Mitigation Measure BIO-113: Compensate for the Near-term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide golden eagle and ferruginous hawk foraging habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any potential for powerline collisions.

***NEPA Effects*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight, and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

***CEQA Conclusion*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on golden eagle or ferruginous hawk.

Impact BIO-115: Indirect Effects of Plan Implementation on Golden Eagle and Ferruginous Hawk

Indirect construction-and operation-related effects: Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1A implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1A implementation would not have an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1A implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1A implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat (Table 12-1A-44).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-1A-44).

Golden eagles and ferruginous hawks would not likely use inundated areas for foraging, and increased frequency and duration of inundation of grassland habitats may affect prey populations that have insufficient time to recover following inundation events. However, periodically inundated habitat would not be expected to have an adverse effect on local or migratory golden eagles or the wintering ferruginous hawk populations in the study area.

***NEPA Effects*:** Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would not be expected to have an adverse effect on the wintering golden eagle or ferruginous hawk populations in the study area.

CEQA Conclusion: Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would be expected to have a less-than-significant impact on the golden eagle and ferruginous hawk populations in the study area.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-1A-45. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP which would also benefit cormorants, herons, and egrets (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in C Z7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activates to enhance natural communities for species, AMM1–AMM7, *AMM18 Swainson's Hawk*, Mitigation Measure BIO-75, and Mitigation Measure BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-45. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting (Rookeries)	58	58	28	28	NA	NA
Total Impacts CM1		**58**	**58**	**28**	**28**	**NA**	**NA**
CM2–CM18	Nesting (Rookeries)	387	684	88	123	51–92	266
Total Impacts CM2–CM18		**387**	**684**	**88**	**123**	**51–92**	**266**
TOTAL IMPACTS		**445**	**742**	**116**	**151**	**51–92**	**266**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 893 acres of modeled nesting habitat (742 acres of permanent loss and 151 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-1A-45). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 86 acres of modeled nesting habitat for cormorants, herons, and egrets (Table 12-1A-45). Of the 86 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 58 acres would be a permanent loss and 28 acres would be a temporary loss of habitat. This loss would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. Activities that would impact modeled nesting habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss would occur where Intakes 1–5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Temporary losses would occur where pipelines cross Snodgrass Slough and other small waterways east of the Sacramento River, and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. There is one great blue heron rookery that is currently intersected by the proposed permanent powerline associated with CM1, east of Little Mandeville Island. Because the species is highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. Therefore to avoid adverse effects on great blue herons (and cormorants, herons, and egrets, should future surveys detect additional rookeries), existing rookeries must be avoided. The transmission line alignment has not been finalized for Alternative 1A, and therefore, avoidance would be feasible. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address this potential effect on cormorants, herons, and egrets. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 177 acres of nesting habitat (89 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential nesting habitat. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 552 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species. There is one CNDDB occurrence of a great blue heron rookery that overlaps with the hypothetical restoration footprint for tidal restoration. The occurrence is on Decker Island and tidal restoration could potentially impact the nest trees from inundation. This effect would need to be addressed within the project specific analysis for tidal restoration projects.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 43 acres and temporarily remove approximately 35 acres of potential cormorants, heron, and egret nesting habitat. These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Because cormorants, herons and egrets are highly traditional in their use of nest sites, all disturbance to nesting birds must be avoided or minimized. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address these adverse effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 561 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 86 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 86 acres of breeding habitat should be restored/created and 86 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid adverse effects on individuals, existing nests and rookeries would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address effects on nesting cormorants, herons, and egrets.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 893 acres of potential breeding habitat (5% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites, and, in order for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

***NEPA Effects*:** The loss of cormorant, heron, and egret habitat and potential for direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place during all project activities, the effects of habitat loss and potential mortality on cormorants, herons, and egrets under Alternative 1A would not be adverse. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. Preconstruction surveys for noncovered species would be required for the BDCP to avoid an adverse effect on individuals. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, andMitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address adverse effects on nesting cormorants, herons, and egrets.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under NEPA. The Plan would remove 561 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 86 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 86 acres of breeding habitat should be restored/created and 86 acres should be protected to mitigate the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 871 acres of potential breeding habitat (5% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites and, for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts sufficient to compensate for the loss of riparian habitats lost to construction and restoration activities, and considering implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, Mitigation Measure BIO-75, and Mitigation Measure BIO-117, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of cormorants, herons, and egrets. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of Plan Implementation on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons, and egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets.

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that cormorant, heron, and egret tissue concentrations would not measurably increase as a result of CM1 implementation.

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly effect on cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cormorants, herons or egrets.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address potential effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would represent an adverse effect in the absence of other conservation actions. This impact would be significant. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium which could result in mortality of special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-7, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-75 and BIO-117 measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on cormorants, herons, and egrets through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 51–92 acres of modeled breeding habitat for cormorants, herons and egrets. However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 266 acres of breeding habitat for cormorants, herons and egrets. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation from CM2 and CM5 would not result in an adverse effect on cormorants, herons and egrets.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation from CM2 and CM5 would have a less-than-significant impact on cormorants, herons and egrets.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-1A-46. Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP which would also benefit short-eared owl and northern harrier (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.2, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-46. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting and Foraging	1,707	1,707	876	876	NA	NA
Total Impacts CM1		**1,707**	**1,707**	**876**	**876**	**NA**	**NA**
CM2–CM18	Nesting and Foraging	12,281	46,700	471	1,224	2,926–8,060	5,978
Total Impacts CM2–CM18		**12,281**	**46,700**	**471**	**1,224**	**2,926–8,060**	**5,978**
TOTAL IMPACTS		**13,988**	**48,407**	**1,347**	**2,100**	**2,926–8,060**	**5,978**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 50,507 acres of modeled habitat for short-eared owl and northern harrier (48,407 acres of permanent loss 2,100 acres of temporary loss, Table 12-1A-46). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), grassland restoration (CM8), vernal pool and wetland restoration (CM9), marsh restoration (CM10) and construction of conservation hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 2,583 acres of modeled short-eared owl and northern harrier habitat (1,707 acres of permanent loss, 876 acres of temporary loss) from CZs 3-6 and CZ 8. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. The majority of habitat removed would consist of grassland and alfalfa fields. There are no occurrences of nesting short-eared owl and northern harrier that overlap with the construction footprint of CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on short-eared owls and northern harriers if they were to nest in or adjacent to construction activities. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 1,021 acres of modeled short-eared owl and northern harrier habitat in the Yolo Bypass in CZ 2. In addition, 471 acres of habitat would be temporarily removed. The impact would primarily consist of loss of acreages of pastures. The conversion is expected to occur during the first 10 years of Plan implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 39,017 acres of modeled short-eared owl and northern harrier habitat. The majority of the losses would be managed wetlands and cultivated lands in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. Tidal restoration actions through CM4 would restore an estimated 55,000 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the extent and value of their nesting habitat. Grizzley Island supports the only known resident population of short-eared owls in the Suisun Marsh and Sacramento-San Joaquin River Delta (Roberson 2008). Grizzley Island does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this is an important breeding area for short-eared owl and if restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding short-eared owls could likely be adverse. Future NEPA and CEQA analysis would be conducted for restoration projects under BDCP and if restoration was proposed to occur outside of the hypothetical footprints used for this programmatic analysis, potential impacts on these species would be captured in the project-level analysis (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,086 acres of modeled short-eared owl and northern harrier habitat (1,332 permanent, 754 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 623 acres of short-eared owl and northern harrier habitat as part of tidal restoration and 2,479 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,066 acres of cultivated lands to grassland in CZs 1, 2, 4, 5, 7, 8, and 11. The resulting 2,000 acres of grassland would provide habitat for short-eared owl and northern harrier.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected

habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize these potential effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of short-eared owl and northern harrier habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 15,537 acres of modeled habitat (14,293 permanent, 1,244 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,583 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 2,583 acres of habitat should be restored and 2,583 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term effects of other conservation actions. The impacts from other near-term conservation actions would be compensated for with tidal and grassland restoration and some portion of the protection of cultivated lands, in addition to management activities initiated through *CM3* and *CM11*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and disposal sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not covered species under the BDCP. In order for the BDCP to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

Late Long-Term Timeframe

The study area supports approximately 406,784 acres of modeled habitat for short-eared owl and northern harrier. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 50,507 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Communities Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP not to have an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects**:** The loss of short-eared owl and northern harrier habitat and potential for direct mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss resulting from Alternative 1A would not be adverse. Short-eared owl and northern harrier are not covered species under the BDCP and preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the effect of direct mortality on short-eared owl and northern harrier.

CEQA Conclusion**:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. The Plan would remove 15,537 acres of modeled habitat (14,293 permanent, 1,244 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,583 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries*

Enhancement, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 2,583 acres of habitat should be restored and 2,583 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term effects of other conservation actions. The impacts from other near-term conservation actions would be compensated for with tidal and grassland restoration and some portion of the protection of cultivated lands, in addition to management activities initiated through *CM3* and *CM11*. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and disposal sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce impacts on nesting short-eared owl and northern harrier to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 406,784 acres of modeled habitat for short-eared owl and northern harrier. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 50,507 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Communities Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives

ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce the impact to a less-than-significant level.

In the absence of other conservation actions, effects on short-eared owl and northern harrier would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

***NEPA Effects*:** The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed for the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60%, which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1A would not result in an adverse effect on short-eared owl or northern harrier.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1A would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of Plan Implementation on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including, *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to short-eared owl and northern harrier could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on short-eared owl and northern harrier.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce short-eared owl and northern harrier use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to bioavailable selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Tidal habitat restoration is unlikely to have an adverse effect on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for short-eared owl and northern harrier, once site specific sampling and other information could be developed.

CEQA Conclusion: Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on short-eared owl and northern harrier with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* and AMM1–AMM7. Tidal habitat restoration is unlikely to have a significant impact on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to bioavailable selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1A implementation would not have a significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 946–2,445 acres of modeled short-eared owl and northern harrier habitat (Table 12-1A-46).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 2,878 acres of modeled habitat (Table 12-1A-46), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects: Increased frequency and duration of inundation of short-eared owl and northern harrier habitat as a result of CM2 and CM5 implementation would not have an adverse effect because inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in the *General Terrestrial Biology Effects* section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on mountain plover. Modeled habitat for mountain plover include grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1A-47. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit the mountain plover (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-47. Changes in Mountain Plover Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Wintering	1,660	1,660	673	673	NA	NA
Total Impacts CM1		**1,660**	**1,660**	**673**	**673**	**NA**	**NA**
CM2–CM18	Wintering	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**7,110**	**27,858**	**1,049**	**1,566**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 29,424 acres of modeled habitat for mountain plover (27,858 acres of permanent loss and 1,566 of temporary loss, Table 12-1A-47). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 2,333 acres of modeled mountain plover habitat (1,660 acres of permanent loss, 673 acres of temporary loss) from CZs 3–6 and CZ 8. The majority of habitat affected would be cultivated lands and grassland that would be removed from CZ 8, from the construction of the new forebay and the potential borrow and spoils site southwest of the proposed forebay. Some of the grassland habitat lost in CZ 8 is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which provides wintering habitat for the species. There are no CNDDB occurrences of mountain plover that intersect with the CM1 footprint. However, the study area does overlap with the species' winter range, and there are occurrences west and north of the study area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled mountain plover wintering habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Plan implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled mountain plover habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of mountain plover wintering habitat as part of tidal restoration and 1,489 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide wintering habitat for mountain plover and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of mountain plover habitat.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small

amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available mountain plover habitat. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled mountain plover habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of

alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on mountain plover wintering in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand mountain plover wintering habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also modeled habitat for wintering mountain plover. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for mountain plover.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would be available to address the effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for mountain plover. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,424 acres of modeled mountain plover wintering habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential wintering habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of mountain plover habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat,* the effects of habitat loss and potential direct mortality on mountain plover under Alternative 1A would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on mountain plover. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson’s hawk (Objective SH1.2) which would also provide potential habitat for mountain plover wintering in the study area. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide habitat for mountain plover.

These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. The implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would reduce the impact of habitat loss in the near-term to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,424 acres of mountain plover habitat during the term of the Plan (11% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities*

Protection and Restoration, CM8 Grassland Natural Communities Restoration, and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on mountain plover would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on mountain plover.

Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide habitat for mountain plover such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allow for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

NEPA Effects: New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on mountain plover. ***CEQA Conclusion***: New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely due to plover's flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of Plan Implementation on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on mountain plover as a result of Alternative 1A implementation could have adverse effects on the species through the modification of habitat. With the implementation of

AMM1–AMM7, indirect effects as a result of Alternative 1A implementation would not have an adverse effect on mountain plover.

***CEQA Conclusion*:** Indirect effects on mountain plover as a result of Alternative 1A implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 1A implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled mountain plover foraging habitat (Table 12-1A-47).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-1A-47). Periodic inundation from CM2 and CM5 would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

***NEPA Effects*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, periodic inundation would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

***CEQA Conclusion*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, periodic inundation would have a less-than-significant impact on mountain plover because birds would be expected to move to adjacent foraging habitat.

Black Tern

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled habitat for black tern as indicated in Table 12-1A-48. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit the black tern (BDCP Chapter 3, *Conservation Strategy*).

- Protect 700 acres of cultivated lands, with at least 500 acres consisting of rice land, to expand upon and buffer newly restored/created nontidal perennial habitat in CZ 2, (Objective GGS2.3, associated with CM3).
- Protect up to 1,700 acres of rice land or equivalent habitat (e.g., perennial wetland) in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake. Any remaining acreage (from a total 2,740 acre commitment) will consist of rice land or equivalent-value habitat outside the Yolo Bypass in CZs 1, 2, 4, or 5 (Objective GGS3.1, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).

Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

As explained below, with the restoration and protection of these amounts of habitat, in addition to management activities that would enhance this habitat for the species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on black tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-48. Changes in Black Tern Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	306	490	1	1	791–1,582	0
Total Impacts CM2–CM18		**306**	**490**	**1**	**1**	**791–1,582**	**0**
TOTAL IMPACTS		**306**	**490**	**1**	**1**	**791–1,582**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

Alternative 1A conservation measures would result in the permanent loss of up to 491 acres of modeled nesting habitat for black tern, consisting of freshwater wetlands and rice in CZ 2 (Table 12-1A-48). Conservation measures that would result in these losses are Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), grassland restoration (CM8) and nontidal marsh restoration (CM10). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 31 acres of modeled black tern habitat in the Yolo Bypass in CZ 2. In addition, 1 acre of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1A implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 199 acres of modeled black tern habitat in CZ 2.

- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 52 acres of rice lands to grassland in CZ 2 by the late-long time period. An estimated 30 acres of impact would occur in the first 10 years.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 208 acres of black tern nesting habitat in in CZ 2. An estimated 46 acres would be removed in the first 10 years.
- CM11 Natural Communities Enhancement and Management: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could disturb nesting black terns if they were to nest in the vicinity of a worksite. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of black tern would be minimized with the implementation of and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.
- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect black tern nesting adjacent to maintenance areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged black tern individuals if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If black tern were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of Mitigation Measure BIO-75.
- Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. This potential impact is further described under Impact BIO-129c below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to compensate for the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to avoid an adverse effect on black tern from habitat loss, protection and restoration of 307 acres of rice and/or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would be available to address this effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater weltands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (Table 3-4 in Chapter 3) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***NEPA Effects*:** The loss of black tern nesting habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection associated with CM3, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss under Alternative 1A would not be adverse under NEPA. Black tern is not a covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:**

Near-term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to mitigate the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored and protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to compensate for black tern habitat loss, the protection and restoration of 307 acres of rice or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would reduce this potential impact to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and avoided. In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1-AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, which would require 1:1 protection of habitat in CZ 2 in the near-term time frame, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (Table 3-4 in Chapter 3) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting terns during preconstruction surveys and ensure that active nests are avoided which would reduce the potential impact on nesting black tern to a less-than-significant level.

In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 1A's protection provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on black tern.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat

Because there is no near-term acreage commitment associated with the protection of rice and the restoration of freshwater wetlands in CZ 2, BDCP proponents must protect and restore rice and/or freshwater wetlands at a 1:1 ratio for each acre of habitat impacted in CZ 2.

Impact BIO-129b: Indirect Effects of Plan Implementation on Black Tern

If black terns were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting black terns. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants that could affect black terns in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including black tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality,* and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on black tern.

Because of the uncertainty that exists at this programmatic level of review, there could be an effect on black tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting individuals. Tidal habitat restoration could result in increased exposure of black tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce these impacts to a less-than–significant level.

Tidal habitat restoration could result in increased exposure of black tern to selenium, which could result in the mortality of a special-status species. This impact would be significant. This impact would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With AMM27 in place, potential effects of increased exposure of black tern to selenium would be reduced to a less-than-significant impact.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass would inundate 791–1,582 acres of suitable black tern nesting habitat (land currently managed as rice in CZ 2). Inundation would occur during the nonbreeding season but could reduce the availability of nesting habitat during years that flooding extends into the nesting season (past March). Extended inundation of the Yolo Bypass would not be expected to affect black tern nesting habitat. However, if periodic inundation took land out of rice production, this could have an adverse effect on black tern nesting habitat. Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. The BDCP has committed to protect, restore and/or create up to 1,700 acres of rice in the Yolo Bypass (Objective GGS3.1). These acres of rice would be protected in areas that are less susceptible to inundation, which would benefit the black tern during years in which the magnitude and duration of inundation were increased.

NEPA Effects: Flooding of the Yolo Bypass is not expected to adversely affect nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential effect would not be adverse with the creation and/or protection of 1,700 acres of rice in CZ 2 under BDCP Objective GGS3.1.

CEQA Conclusion: Flooding of the Yolo Bypass is not expected to have a significant impact on nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production, it could also reduce suitable black tern nesting habitat. This potential impact would be reduced to a less-than-significant level by the creation and/or protection of 1,700 acres of rice in CZ 2 under BDCP Objective GGS3.1.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of nesting habitat in the Plan Area, which includes grassland, vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-1A-49. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit the California horned lark and the grasshopper sparrow (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).

- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-49. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	1,660	1,660	673	673	NA	NA
Total Impacts CM1		**1,660**	**1,660**	**673**	**673**	**NA**	**NA**
CM2–CM18	Breeding	5,450	26,198	376	893	777–2,423	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**777–2,423**	**3,823**
TOTAL IMPACTS		**7,110**	**27,858**	**1,049**	**1,566**	**777–2,423**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 29,424 acres of modeled nesting habitat for California horned lark and grasshopper sparrow (27,858 acres of permanent loss and 1,566 of temporary loss, Table 12-1A-49). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 2,333 acres of modeled California horned lark and grasshopper sparrow habitat (1,660 acres of permanent loss, 673 acres of temporary loss) from CZs 3–6 and CZ 8. The majority of habitat that would be removed would be in CZ 8, from the construction of the new forebay and from the potential borrow and spoils site south of the proposed forebay. Some of this habitat south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which is suitable nesting habitat for these species. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 1–5 (6 occurrences), in the Stone Lakes NWR. However, the CM1 footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on California horned larks and grasshopper sparrows if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled California horned lark and grasshopper sparrow habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Plan implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled California horned lark and grasshopper sparrow nesting habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of California horned lark and grasshopper sparrow nesting habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide nesting habitat for California horned lark and grasshopper sparrow and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of California horned lark and grasshopper sparrow nesting habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address these potential effects.
- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled California horned lark and grasshopper sparrow habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were

present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would be available to address the effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP not to have an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of modeled California horned lark and grasshopper sparrow habitat. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,494 acres of modeled habitat for these species over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) and would provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

NEPA Effects: The loss of California horned lark and grasshopper sparrow habitat and potential for mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the effects of habitat loss under Alternative 1A on California horned lark and grasshopper sparrow would not be adverse. California horned lark and grasshopper sparrow are not covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 8,167 acres (7,110 permanent, 1,049 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CMµ7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the CM1 losses of 2,333 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would reduce the impact of habitat loss in the near-term to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,424 acres of modeled California horned lark and grasshopper sparrow nesting habitat during the term of the Plan (11% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid significant impacts on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California*

Horned Lark and Grasshopper Sparrow Habitat, the loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide California horned lark and grasshopper sparrow habitat such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1 protection. Additional grassland protection, enhancement, and management may be substituted for the protection of cultivated lands.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. *AMM20 Greater Sandhill Crane* would minimize the risk of bird strikes. Thus, there would be no adverse effect.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane* the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane* into the BDCP, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of Plan Implementation on Grasshopper Sparrow and California Horned Lark

Indirect construction-and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to grasshopper sparrow and California horned lark and grasshopper sparrow nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 1A implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. California horned lark and grasshopper sparrow are not covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 1A implementation could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on California Horned Lark and Grasshopper Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158-3,650 acres of modeled California horned lark and grasshopper sparrow habitat (Table 12-1A-49).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 656 acres of modeled habitat (Table 12-1A-49).

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

***NEPA Effects*:** Periodic inundation of floodplains would not have adverse effects on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis includes tidal freshwater emergent wetlands, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZs 2, 4, and 11. Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1A-50. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit least bittern and white-faced ibis (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-50. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	0	0	77	77	NA	NA
Total Impacts CM1		**0**	**0**	**77**	**77**	**NA**	**NA**
CM2–CM18	Nesting	5,134	13,063	45	45	961–2,672	NA
Total Impacts CM2–CM18		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**
TOTAL IMPACTS		**5,134**	**13,063**	**122**	**122**	**961–2,672**	**NA**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 13,185 acres of modeled habitat for least bittern and white-faced ibis (13,063 acres of permanent loss and 122 of temporary loss, Table 12-1A-50). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11), which would include ground disturbance and removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the temporary loss of up to 77 acres of modeled least bittern and white-faced ibis habitat from CZ 4. The construction footprint for CM1 does not overlap with any occurrences of least bittern or white-faced ibis. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1A implementation.
- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 55 acres of modeled least bittern and white-faced ibis habitat in the

Yolo Bypass in CZ 2. In addition, 45 acres of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 13,008 acres of modeled least bittern and white-faced ibis habitat in CZ 2, 4, and 11 by the late long-term time period.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 described below and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce potential effects.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,256 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,134 acres of permanent loss, and 122 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 77 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 77 acres of habitat should be restored and 77 acres of habitat should be protected to compensate for the CM1 losses of 77 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland and protecting and enhancing 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 13,185 acres (13,063 acres of permanent loss, 122 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP not to have an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

NEPA Effects: The loss of least bittern and white-faced ibis habitat and potential mortality of these special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, with the habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss on least bittern and white-faced ibis would not be adverse under Alternative 1A. Least bittern and white-faced ibis are not covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. The Plan would remove 5,256 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,134 acres of permanent loss, and 122 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 77 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 77 acres of habitat should be restored and 77 acres of habitat should be protected to compensate for the CM1 losses of 77 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal freshwater emergent wetland and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys would be required to ensure that nests were detected and avoided. Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the potential impact on nesting least bittern and white-faced ibis to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 13,185 acres (13,063 acres of permanent loss, 122 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. To avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting least bittern and white-faced ibis and to a less-than-significant level.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio that limits their maneuverability and makes them more vulnerable to collisions than more agile species are (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters, which would reduce bird strike risk of least bittern and white-faced ibis.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio that limits their maneuverability and makes them more vulnerable to collisions than more agile species are. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio that limits their maneuverability and makes them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of Plan Implementation on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to least bittern and white-faced ibis could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of other conservation actions. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the potential indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of plan implementation would represent a substantial adverse effect in the absence of other conservation actions. This impact would be significant. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of plan implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other conservation measures. This would be a significant impact. With AMM1–AMM7, *AMM27 Selenium Management*, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 961–2,672 acres of modeled least bittern and white-faced ibis habitat (Table 12-1A-50). However, no adverse effects of increased inundation frequency on nesting habitat are expected because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types. Inundation would occur in the nonbreeding season and wetlands supporting habitat would not be expected to be affected by flood flows.

NEPA Effects: Periodic inundation of Yolo Bypass would not be expected to have adverse effects on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and duration of inundation would be within the tolerance of these vegetation types.

CEQA Conclusion: Periodic inundation of Yolo Bypass would not be expected to have a significant impact on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and duration of inundation would be within the tolerance of these vegetation types.

Loggerhead Shrike

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-1A-51. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit loggerhead shrike (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).

- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-51. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	1,660	1,660	673	673	NA	NA
	Low-value	1,573	1,573	616	616	NA	NA
Total Impacts CM1		**3,233**	**3,233**	**1,289**	**1,289**	**NA**	**NA**
CM2–CM18	High-value	5,450	26,198	376	893	777–2,423	3,823
	Low-value	1,801	17,575	97	624	672–1,996	4,315
Total Impacts CM2–CM18		**7,251**	**43,723**	**474**	**1,517**	**1,830–5,646**	**8,138**
Total High-value		**7,110**	**27,858**	**1,049**	**1,566**	**777–2,423**	**3,823**
Total Low-value		**3,374**	**19,148**	**713**	**1,240**	**672–1,996**	**4,315**
TOTAL IMPACTS		**10,484**	**47,006**	**1,762**	**2,806**	**1,830–5,646**	**8,138**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 1A conservation measures would result in the combined permanent loss or conversion and temporary loss of up to 49,812 acres of modeled habitat for loggerhead shrike (29,424 acres of which would be high-value habitat, Table 12-1A-51). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), natural communities enhancement and management (CM11) and construction of conservation hatcheries (CM18). The majority of habitat loss (33,244 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 2,333 acres of high-value loggerhead shrike habitat (1,660 acres of permanent loss, 673 acres of temporary loss). In addition, 2,189 acres of low-value habitat would be removed (1,573 acres of permanent loss or conversion, 616 acres of temporary loss or conversion). The largest impact from CM1 on loggerhead shrike habitat would occur in CZ 8, where there are larger stands of ruderal and herbaceous vegetation and California annual grassland, which provides high-value habitat for the species. Approximately 685 acres of impact would be from the new forebay constructed south of Clifton Court Forebay and from the potential borrow and spoils site southwest of the proposed forebay. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Loggerhead shrikes nest in high abundance in shurbs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). There are 4 loggerhead shrike occurrences that intersect with the construction footprint for the new forebay. In addition, one occurrence intersects with the footprint for a permanent transmission line south of the forebay. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on nesting loggerhead shrikes. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of high-value loggerhead shrike habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 182 acres of low-value habitat would be removed (85 acres of permanent loss, 97 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of high-value loggerhead shrike habitat and 12,364 acres of low-value habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of high-value loggerhead shrike habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of high-value loggerhead shrike habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration. In addition, 503 acres of low-value habitat would be removed as a part of tidal restoration and 1,971 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide habitat for loggerhead shrike and would result in the conversion of 1,849 acres of cultivated lands to high-value grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of high-value loggerhead shrike habitat and 735 acres of low-value loggerhead shrike habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Fences (e.g. barbed wire) installed as part of CM11 in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If the species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these potential effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value loggerhead shrike habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. Hatchery construction is expected to occur within the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 8,159 acres (7,110 permanent, 1,049 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 4,087 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,189 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would be available to address the effect of near-term, high-value habitat loss. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential effect from the loss of low-value loggerhead shrike foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B of the Final EIR/EIS.

The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the combined permanent of and temporary effects on 29,424 acres of high-value habitat and 20,388 acres of low-value loggerhead shrike habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7 Riparian Natural Community Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting*

Bird Surveys and Avoid Disturbance of Nesting Birds, would be available to address this potential effect.

NEPA Effects: The loss of loggerhead shrike habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities, and AMM18 Swainson's Hawk*, and with implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss on loggerhead shrike under Alternative 1A would not be adverse. Loggerhead shrike is not a covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 8,159 acres (7,110 permanent, 1,049 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,333 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 4,087 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,189 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 4,666 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4

in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1.

With the acres of habitat protection and restoration described above, in addition to Mitigation Measure BIO-138, *Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat*, Alternative 1A would not result in a substantial adverse effect through loss of high-value habitat. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential substantial impact from the loss of low-value loggerhead shrike foraging habitat. In addition, AMM1-AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid potentially significant impacts on nesting individuals. With these measures in place, Alternative 1A would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 1A would have a less-than-significant impact on loggerhead shrike.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 29,692 acres of high-value loggerhead shrike habitat during the term of the Plan. In addition, 21,047 acres of low-value loggerhead shrike habitat would be impacted. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the loss of habitat and direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on loggerhead shrike.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat

Because the BDCP does not include acreage commitments for the protection of crop types in the near-term time period, DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa as high-value loggerhead shrike habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on loggerhead shrike.

***CEQA Conclusion*:** Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 1A would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of Plan Implementation on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on loggerhead shrike as a result of Plan implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. The loggerhead shrike is not a covered species under the BDCP and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 1A implementation could have a significant impact on these species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on 1,830–5,646 acres of modeled loggerhead shrike habitat (consisting of approximately 777–2,423 acres of high-value habitat; Table 12-1A-51).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 8,138 acres of modeled habitat (Table 12-1A-51), consisting of 3,823 acres of high-value and 4,315 acres of low-value habitat.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would have a less-than-significant impact on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

Song Sparrow “Modesto” Population

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on Modesto song sparrow. The

Modesto song sparrow is common and ubiquitous throughout the study area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-1A-52. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit Modesto song sparrow (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)
- Create 500 acres of managed wetlands in CZ 3, 4, 5, or 6 (Objectives GSHC1.3 and GSHC1.4, associated with CM10).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs and Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-52. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	70	70	116	116	NA	NA
Total Impacts CM1		**70**	**70**	**116**	**116**	**NA**	**NA**
CM2–CM18	Nesting	2,444	3,253	133	169	81–158	284
Total Impacts CM2–CM18		**2,444**	**3,253**	**133**	**169**	**81–158**	**284**
TOTAL IMPACTS		**2,514**	**3,323**	**249**	**285**	**81–158**	**284**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 3,608 acres of modeled habitat for Modesto song sparrow (3,323 acres of permanent loss and 285 acres of temporary loss of habitat, Table 12-1A-52). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance and removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 186 acres of modeled Modesto song sparrow habitat 70 acres of permanent loss, 116 acres of temporary loss) from CZs 3–6 and CZ 8. The CM1 construction footprint overlaps with nine Modesto song sparrow occurrences and the species is ubiquitous throughout the Delta. The footprint for the new forebay overlaps with three occurrences, and a temporary intake work area and temporary pipeline work area overlap with 6 occurrences. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Construction of the water conveyance facilities would occur within the first 10 years of Alternative 1A implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 143 acres of modeled Modesto song sparrow habitat in the Yolo Bypass in CZ 2. In addition, 133 acres of habitat would be temporarily removed. These losses would occur in the near-term timeframe and primarily consist of valley/foothill riparian natural community and managed wetland. The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated loss of 3,066 acres of modeled Modesto song sparrow habitat by the late long-term.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 80 acres of modeled Modesto song sparrow habitat (44 permanent, 36 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7. The BDCP is expected to restore approximately 5,000 acres of valley/foothill riparian natural community. These lands would be managed as a mosaic of seral stages, age classes, and plant heights, some of which would provide suitable nesting habitat for Modesto song sparrow.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP.

  Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these potential effects.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 2,763 acres of modeled habitat (2,514 permanent, 249 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 186 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 186 acres of suitable habitat should be restored/created and 186 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 8,850 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs 2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 3,608 acres (3,323 acres of permanent loss, 285 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

NEPA Effects: The loss of Modesto song sparrow habitat and potential for mortality of this special-status species under Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss on Modesto song sparrow under Alternative 1A would not be adverse. The Modesto song sparrow is not a covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 2,763 acres of modeled habitat (2,514 permanent, 249 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 186 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 186 acres of suitable habitat should be restored/created and 186 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 8,850 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding a significant impact of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1A as a whole would result in the permanent loss of and temporary effects on 3,608 acres (3,323 acres of permanent loss, 285 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to minimize direct mortality of individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

***NEPA Effects*:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

***CEQA Conclusion*:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow

Impact BIO-144: Indirect Effects of Plan Implementation on Modesto Song Sparrow

Indirect construction-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species.

Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential effects on Modesto song sparrow.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow, and floodplain restoration has the potential to mobilize selenium and, therefore, to increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Modesto song sparrow.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Modesto song sparrow from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 1A water conveyance facilities could adversely affect individuals in the absence of other conservation actions. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would minimize this potential effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Modesto song sparrow, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Indirect effects on Modesto song sparrow as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct*

Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would reduce this impact to a less-than-significant level. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 81-158 acres of modeled Modesto song sparrow habitat. However, inundation would occur during the nonbreeding season. Reduced foraging habitat availability would be expected during the fledgling period of the nesting season due to periodic inundation.

Based on hypothetical floodplain restoration, construction of setback levees from seasonally inundated floodplain restoration (CM5) could result in periodic inundation of up to approximately 284 acres of Modesto song sparrow modeled habitat (Table 12-1A-52).

The periodic inundation of the Yolo Bypass (CM2) and of seasonal floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat, but may reduce the availability of nesting habitat during years when flooding extends into the nesting season (after March).

NEPA Effects: Periodic effects of inundation would not result in an adverse effect on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that provide Modesto song sparrow habitat.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that provide Modesto song sparrow habitat.

Bank Swallow

This section describes the effects of Alternative 1A, including construction and implementation of other conservation components, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70–90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Construction and restoration associated with Alternative 1A conservation measures would not result in the direct loss of modeled habitat for bank swallow (Table 12-1A-53). However, indirect effects of noise and visual disturbance resulting from *CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat.

As explained below, impacts on bank swallow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-1A-53. Changes in Bank Swallow Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities from *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration*, including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in in CZ 2 and CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect effects on bank swallow. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce these indirect effects on construction on bank swallow.

***NEPA Effects*:** Construction activities associated with habitat restoration could adversely affect bank swallow colonies. Noise and visual disturbances could result in adverse effects on bank swallows if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this potential effect.

***CEQA Conclusion*:** Construction activities associated with habitat restoration could result in a significant impact on bank swallow colonies. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, BDCP proponents will not construct conservation components during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWR will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization.

Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the March when the swallows have nested and layed eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses which resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Section 5.3.1, Chapter 5, *Water Supply*, for a description of the model).

On the Sacramento River, at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 1A could increase between April and August in all but wet years at the Keswick flow gauge based on modeling assumptions (Table 1 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model*

Results Utilized in the Fish Analysis) and in dry and critical years at the gauge upstream of Red Bluff (Table 3 of Section 11C.1.1 in Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) which could lead to inundation of active colonies. However, model outputs indicate that flows under Existing Conditions and the predicted flows in the late long-term without the project (NAA) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (Table 15 in Section 11C.1.1 and Table 17 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). In addition, on the Sacramento River in average, above normal, and wet water years, flows at the Verona gauge are predicted to be greater than 14,000 cfs during some months of the breeding season, which could lead to bank collapse events (Tables 1, 3, and 7 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). However, flows of this height are recorded under Existing Conditions at this flow gauge and are also predicted for the late long-term time without the project (NAA).

***NEPA Effects*:** High spring flows in the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1A would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of upstream impacts on bank swallow resulting from changes in operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse upstream effects of operations on bank swallow.

***CEQA Conclusion*:** High spring flows in the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1A would not differ substantially from those under the Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of upstream impacts on bank swallow resulting from changes in operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potentially significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitoring[1] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would result inloss of active nest sites or degradation of available nesting habitat, and the extent to

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[1] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on yellow-headed blackbird. The habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. These natural communities support aquatic insects which are important prey items for yellow-headed blackbird young (Beedy 2008). Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-1A-54. Full implementation of Alternative 1A would include the following biological objectives over the term of the BDCP which would also benefit yellow-headed blackbird (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objective ASWNC1.1, Objective VPNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.3, associated with CM3).

- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-54. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	11	11	89	89	NA	NA
	Foraging	1,696	1,696	685	685	NA	NA
Total Impacts CM1		**1,707**	**1,707**	**774**	**774**	**NA**	**NA**
CM2–CM18	Nesting	5,814	13,902	45	46	961–2,678	18
	Foraging	5,612	26,673	376	905	368–1,476	2,701
Total Impacts CM2–CM18		**11,426**	**40,575**	**421**	**951**	**1,495–4,394**	**2,719**
Total Nesting		**5,825**	**13,913**	**134**	**135**	**961–2,678**	**18**
Total Foraging		**7,308**	**28,369**	**1,061**	**1,590**	**368–1,476**	**2,701**
TOTAL IMPACTS		**13,133**	**42,282**	**1,195**	**1,725**	**1,495–4,394**	**2,719**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 44,007 acres of modeled habitat (14,048 acres of nesting habitat and 29,959 acres of foraging habitat) for yellow-headed blackbird (Table 12-1A-54). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Conveyance Facilities and Operation*: Construction of Alternative 1A water conveyance facilities would result in the combined permanent and temporary loss of up to 100 acres of yellow-headed blackbird nesting habitat (11 acres of permanent loss and 89 acres of temporary loss). In addition, 2,381 acres of foraging habitat would be removed (1,696 acres of permanent loss, 685 acres of temporary loss). (Table 12-1A-54). Activities that would impact suitable yellow-headed blackbird habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. The largest losses of foraging habitat would occur from loss of corn. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for CM1. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on yellow-headed blackbirds if they were to nest in or adjacent to construction areas. Impacts resulting from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 100 acres of nesting habitat (55 acres of permanent loss, 45 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,144 acres of foraging habitat would be removed (879 acres of permanent loss, 265 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1A implementation.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation from CM4 would permanently remove or convert an estimated 13,847 acres of nesting habitat, which would consist primarily of managed wetland. In addition, 20,029 acres of foraging habitat would be lost or converted as a result of tidal restoration, over half of which would be from the loss or conversion of alfalfa. However, the resulting 65,000 acres of tidal natural communities would also provide habitat for the species, 24,000 acres of which would be tidal freshwater natural communities providing breeding habitat for yellow-headed blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 2 acres of yellow-headed blackbird nesting habitat (1 acres of permanent loss, 1 acres of temporary loss) and 1,641 acres of foraging habitat (1,051 acres of permanent loss, 590 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1A implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 509 acres of yellow-headed blackbird foraging habitat as part of tidal restoration and 2,033 acres as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 926 acres of yellow-headed blackbird agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of foraging habitat value.
- CM8 would result in the restoration of 2,000 acres of grassland foraging habitat in the study area.
- *CM10 Nontidal Marsh Restoration:* Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 988 acres of cultivated lands foraging habitat to nontidal marsh in CZ 2 and CZ 4. Yellow-headed blackbird nesting habitat may develop along the margins of restored nontidal marsh and restoration would also provide foraging habitat for the species.
- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland foraging habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-yellow-headed blackbird foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these potential effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,959 acres (5,825 acres of permanent loss, 134 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 100 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 8,369 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 2,381 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 100 acres of nesting habitat should be restored/created and 100 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 2,381 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 14,048 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 29,959 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (Table 3.3-6 in BDCP Chapter 3). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects: The loss of yellow-headed blackbird habitat and potential for direct mortality of this special-status species associated with Alternative 1A would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM8, CM10, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss would not be adverse under Alternative 1A. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 5,959 acres (5,825 acres of permanent loss, 134 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 8,369 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 2,381 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 100 acres of nesting habitat should be restored/created and 100 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 2,381 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures. With the acres of habitat protection and restoration described above, in addition to AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, Alternative 1A would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 1A would have a less-than-significant impact on yellow-headed blackbird.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 14,048 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 29,959 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, CZ 8, and CZ 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (Table 3.3-6 in BDCP Chapter 3). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1A's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts necessary to compensate for habitat lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-headed blackbird. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would reduce the potential for yellow-headed blackbird collision with transmission lines. Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1A would not result in an adverse effect on yellow-headed blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 1A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of Plan Implementation on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize potential effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP*

Revisions) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird, and floodplain restoration has the potential to mobilize selenium and, therefore, to increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1A restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-headed blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-headed blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury, in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: In the absence of other conservation actions, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1A would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than significant.

Indirect effects of plan implementation would represent an adverse effect on yellow-headed blackbird in the absence of other conservation measures. This would be a significant impact. With AMM1–AMM7, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of plan implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 961–2,678 acres of nesting habitat and 368–2,678 acres of foraging habitat (Table 12-1A-54). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 18 acres of nesting habitat and 2,701 acres of foraging habitat (Table 12-1A-54) resulting in the temporary loss of these habitats. Foraging yellow-headed blackbirds would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would not have an adverse effect on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat may be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat would be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-1A-55. Full implementation of Alternative 1A would also include biological objectives over the term of the BDCP to benefit the riparian brush rabbit (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian brush rabbit, with conservation principles involves protecting, restoring or creating, and maintaining habitat and corridors near the largest remaining fragments of habitat and extant populations; providing high-water refugia from flooding; and managing feral predators (dogs and cats) in areas occupied by the species. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5, CM7, and CM11).

- Of the 750 acres of protected valley/foothill riparian natural community protected under Objective VFRNC1.2, protect at least 200 acres of suitable riparian brush rabbit habitat (defined in CM7 Riparian Natural Community Restoration) that is occupied by the species or contiguous with occupied habitat (Objective RBR1.1, associated with 3).
- Of the 1,000 acres of early- to midsuccessional riparian habitat maintained under VFRNC2.2, maintain at least 800 acres within the range of the riparian brush rabbit (CZ 7), in areas that are adjacent to or that facilitate connectivity with occupied or potentially occupied habitat (Objective RBR1.2, associated with CM3, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain at least 300 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Objective 1.3, associated with CM3, CM7, and CM11).
- Create and maintain high-water refugia in the 300 acres of restored riparian brush rabbit habitat and the 200 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Objective RBR1.4, associated with CM7 and CM11).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Objective RBR1.5, associated with CM11).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres of grasslands restored under Objective GNC1.2, protect or restore grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6m associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-55. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	7	7	1	1	NA	NA
	Grassland	150	150	30	30	NA	NA
Total Impacts CM1		**157**	**157**	**31**	**31**	**NA**	**NA**
CM2–CM18	Riparian	0	62	0	35	0	264
	Grassland	0	44	0	20	0	423
Total Impacts CM2–CM18		**0**	**106**	**0**	**55**	**0**	**687**
TOTAL IMPACTS		**157**	**263**	**31**	**86**	**0**	**687**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 1A conservation measures would result in the permanent and temporary loss of up to 105 acres of riparian habitat and 244 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-1A-55). The hypothetical footprint for levee construction under CM5, overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange. Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions. Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 1A water conveyance facilities would result in the permanent removal of approximately 7 acres of riparian habitat and 150 acres of associated grassland habitat and in the temporary removal of 1 acre of riparian habitat and 30 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-1A-55). The riparian habitat that would be removed is of low value for the riparian brush rabbit as it consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court

Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 19 acres of riparian habitat and 18 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. The riparian habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by agricultural lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. The habitat that would be removed is not adjacent to any existing conserved lands, and is several miles north and northeast of the northernmost riparian brush rabbit record located northeast of Paradise Cut (Williams et al. 2002). Although the final footprint for tidal natural communities restoration would differ from the hypothetical footprint, compliance monitoring would be implemented to ensure that acreage limits are not exceeded and the measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian brush rabbit.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 43 acres of riparian habitat and 26 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late longterm. Levee construction would also result in the temporary removal of 35 acre riparian habitat and 20 acres of grassland habitat for the riparian brush rabbit. Although the effects are considered temporary, five years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected. The value of this habitat for riparian brush rabbit is high: although it consists of small patches and narrow bands of riparian vegetation, these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange.

  Although the final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis, restoration of the river floodplain in CZ 7 would be targeted in the general area of the riparian brush rabbit population. Implementation of adaptive management described in AMM25 would ensure that riparian brush rabbit habitat permanently removed as a result of floodplain restoration does not exceed maximum allowable habitat loss for this species.

- *CM11 Natural Communities Enhancement and Management* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37 Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: Ongoing maintenance of BDCP facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.
- Recreation: Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, AMM37, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, *Avoidance and Minimization Measures*, limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.
- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbits because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian brush rabbit because tidal natural communities restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix B, *Environmental Commitments, AMMs, and CMs*). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian brush rabbits: however, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction (AMM25).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1A would result in permanent and temporary effects combined on 8 acres of riparian habitat and 180 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 8 acres of riparian habitat should be restored, 8 acres of riparian habitat should be protected, and 360 acres of grassland should be protected for riparian brush rabbit to mitigate near-term losses. The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1 and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1–RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 10 acres of riparian habitat restored, 10 acres of riparian habitat protected, and 334 acres of grassland protected.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Presentation Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, and *AMM37 Recreation*. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1A a whole would result in permanent and temporary effects combined on 105 acres of modeled riparian habitat and 244 acres of modeled grassland habitat for riparian brush rabbit rabbit in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

NEPA Effects: In the near-term, the loss of riparian brush rabbit habitat under Alternative 1A would not be adverse because there is little likelihood of riparian brush rabbits being present and the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of riparian brush rabbit riparian and grassland habitat associated with Alternative 1A, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the effects of Alternative 1A as a whole on riparian brush rabbit would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide

sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 1A would result in permanent and temporary effects combined on 8 acres of riparian habitat and 180 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 8 acres of riparian habitat should be restored, 8 acres of riparian habitat should be protected, and 360 acres of grassland should be protected for riparian brush rabbit to mitigate near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1-RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 8 acres of riparian habitat restored, 8 acres protected, and 360 acres of grassland protected.

The plan also contains commitments to implement AMM1–AMM7, AMM10, AMM25, and AMM37. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1A a whole would result in permanent and temporary effects combined on 105 acres of modeled riparian habitat and 244 acres of modeled grassland habitat for riparian brush rabbit in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

Only a small proportion of the habitat losses would be considered occupied and of high value. Alternative 1A conservation measures provide for large acreages of riparian brush rabbit riparian and grassland habitat to be protected and restored, and the BDCP includes AMM1–AMM7, AMM10, AMM25, and AMM37, which are directed at minimizing or avoiding potential impacts during construction and operation of the conservation measures. Overall, Alternative 1A would provide a substantial net benefit to the riparian brush rabbit through the increase in available habitat and habitat in protected status.

Considering the habitat restoration and protection associated with CM3, CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the temporary and permanent losses of riparian and grassland habitat and potential direct mortality of riparian brush rabbit as a result of implementing Alternative 1A would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. The loss of habitat and potential mortality of riparian brush rabbits would be a less-than-significant impact under CEQA.

Impact BIO-153: Indirect Effects of Plan Implementation on Riparian Brush Rabbit

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat. These construction activities would include water conveyance (including transmission line) construction in CZ 8, tidal natural communities restoration construction, and construction of setback levees. Water conveyance construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area;; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. Tidal natural communities restoration construction would also potentially affect adjacent riparian habitat and associated grassland habitat for this species: however, adverse effects on the species are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian brush rabbit. The activity most likely to result in noise, lighting, and visual disturbances to riparian brush rabbit is the construction of setback levees for floodplain restoration, which would take place in CZ 7, where the species is known to occur. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1A would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 1A would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise, lighting, andvisual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 1A, the BDCP would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 1A would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian brush rabbit habitat. This activity would periodically inundate approximately 264 acres of riparian habitat (9% of riparian habitat in the Plan Area) and 423 acres of associated grassland habitat (14% of associated grassland habitat in the Plan Area) for the riparian brush rabbit. The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of high-value habitat for the species: although they consist of small patches and narrow bands of riparian vegetation, many of these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The restored floodplain would include a range of elevations from lower lying areas that flood frequently (e.g., every 1 to 2 years) to higher elevation areas that flood infrequently (e.g., every 10 years or more).

Seasonal flooding in restored floodplains can result in injury or mortality of individuals if riparian brush rabbits occupy these areas and cannot escape flood waters. One recorded occurrence of riparian brush rabbit (Williams et al. 2002), just west of Stewart Road in Mossdale, is in the area that would be seasonally flooded based on the hypothetical restoration footprint.

NEPA Effects: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1A, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, Alternative 1A would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The overall effect of seasonal inundation on existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for covered riparian species, such as the riparian brush rabbit. Long-term management of riparian areas would ensure that refugia also exist along the edges of seasonally inundated habitat.

The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1A, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Periodic inundation of riparian and grassland habitat for riparian brush rabbit under Alternative 1A would have a less-than-significant impact on the species.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the BDCP area in CZ 7, south of State Route 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47). Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of riparian woodrat modeled habitat as indicated in Table 12-1A-56. Tidal habitat restoration, floodplain restoration, and protection and management of natural communities could affect modeled riparian woodrat habitat. However, because the species is not known to occur in the study area it is not expected to be affected by BDCP actions unless the species were to establish in the study area over the term of the BDCP. Full implementation of Alternative 1A would also include biological objectives over the term of the BDCP to benefit the riparian woodrat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian woodrat involves providing opportunities for population expansion into the Plan Area from adjacent lands to the south and southeast. The strategy focuses on restoring and maintaining suitable habitat at the southernmost end of CZ 7, providing connectivity with existing populations to the south and southeast, and creating and maintaining flood refugia. This conservation approach is consistent with the recovery plan (U.S. Fish and Wildlife Service 1998) and conservation principles (BDCP Appendix 3.E). The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM5, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain 300 acres riparian habitat in CZ 7 that meets the ecological requirements of the riparian woodrat (i.e., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat (Objective RW1.1, associated with CM3, CM7, CM11).
- Provide and maintain high-water refugia in the 300 acres of riparian woodrat habitat restored under Objective RW1.1 through the retention, construction, and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 67 feet (Objective RW1.2, associated with CM7 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on riparian woodrat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-56. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Riparian	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Riparian	0	51	0	33	0	203
Total Impacts CM2–CM18		**0**	**51**	**0**	**33**	**0**	**203**
TOTAL IMPACTS		**0**	**51**	**0**	**33**	**0**	**203**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

- Alternative 1A conservation measures would result in the permanent loss of up to 51 acres of habitat and temporary loss of up to 33 acres of modeled habitat for riparian woodrat (Table 12-1A-56). There are no riparian woodrat occurrences that overlap with the Plan footprint. Construction of Alternative 1A water conveyance facilities (CM1) would not affect modeled riparian woodrat habitat; however, tidal natural communities restoration (CM4) and seasonally inundated floodplain restoration (CM5) would remove habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled habitat for the riparian woodrat in CZ 7. This habitat is of low value, consisting of a small, isolated patch surrounded by agricultural lands, and the species has a relatively low likelihood of being present in these areas. The measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian woodrat as determined by presence/absence surveys. Because the estimates of habitat loss due to tidal inundation are based on projections of where restoration may occur, actual habitat loss is expected to be lower because sites would be selected to minimize effects on riparian woodrat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 41 acres of modeled habitat for the riparian woodrat in CZ 7. The value of this habitat for riparian woodrat is moderate. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River. There are two species occurrences immediately south of CZ 7, one of which is less than 1.5 mile from the southernmost patch of riparian habitat potentially affected by levee construction.

  The final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis. However, monitoring and adaptive management described in *CM11 Natural Communities Enhancement and Management*, and AMM25 would ensure that riparian woodrat habitat permanently removed does not exceed the amount estimated based on the hypothetical footprint. Habitat loss is expected to be lower than 41 acres because sites would be selected and restoration designed to minimize effects on the riparian woodrat. If natural flooding is insufficient to maintain appropriate riparian woodrat vegetation structure, the vegetation would be actively managed to provide suitable habitat structure as described in *CM11 Natural Communities Enhancement and Management.*

  Levee construction would also result in the temporary removal of 33 acres of modeled habitat for the riparian woodrat. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian woodrat habitat. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian woodrat habitat and are expected to result in overall improvements to and maintenance of riparian woodrat habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below

- Operations and maintenance: The only ongoing effects on the riparian woodrat are those potentially resulting from habitat enhancement and management activities. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities may result in harassment of riparian woodrats through noise and visual disturbance which would be minimized with implementation of AMM1–AMM7, AMM10, and AMM25.
- Injury and direct mortality: Construction vehicle activity is not likely to result in injury or mortality of individual riparian woodrats because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian woodrats because tidal natural communities restoration projects would be designed to avoid occupied riparian woodrat habitat and if that is not possible to trap and relocate the species (AMM25). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats: however, preconstruction surveys, construction monitoring, and other measures would be implemented under AMM25 to avoid and minimize injury or mortality of this species during construction, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. If occupied riparian woodrat habitat cannot be avoided, mortality would be avoided through implementation of a trapping and relocation program. The program would be developed in coordination with USFWS, and relocation would be to a site approved by USFWS prior to construction activities.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

No riparian woodrat habitat would be lost in the near-term timeframe. Implementation of CM11 could have minor adverse effects on available riparian woodrat habitat, and activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be not be adverse under NEPA, because no riparian woodrat habitat would be lost and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 2,166 acres of riparian woodrat habitat. Alternative 1A as a whole would result in the permanent loss of and temporary removal of 84 acres of modeled habitat for riparian woodrat habitat during the late long-term. This represents 2% of the riparian modeled habitat in the study area. None of this habitat is considered occupied.

Alternative 1A would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (*CM3*) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

Alternative 1A would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 1A conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

NEPA Effects**:** Alternative 1A would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrat should they occupy study area habitats. Should the species be detected in the study area, AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have an adverse effect on riparian woodrat.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes.

No riparian woodrat habitat would be lost in the near-term timeframe. Implementation of CM11 could have minor adverse effects on available riparian woodrat habitat, and activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. The Plan also contains commitments to implement AMM1-AMM7, AMM10, and AMM25, which include elements that avoid or minimize the risk of affected habitats and species adjacent to work areas.

BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA, because no riparian woodrat habitat would be lost and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 2,166 acres of riparian woodrat habitat. Alternative 1A as a whole would result in the permanent loss and temporary removal of 84 acres of modeled habitat for riparian woodrat habitat during the late long-term. This represents 2% of the riparian modeled habitat in the study area. None of this habitat is considered occupied.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in C Z7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in C Z7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (CM3) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

Alternative 1A would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 1A conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

Alternative 1A would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrat. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have a significant impact on riparian woodrat.

Impact BIO-156: Indirect Effects of Plan Implementation on Riparian Woodrat

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled habitat for riparian woodrat. These effects are related to construction activities associated with tidal natural communities restoration (CM4) and construction of setback levees (CM5). Indirect effects on the species from construction associated with tidal natural communities restoration are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian woodrat (AMM25). The activity most likely to result in noise, lighting, and visual disturbances to riparian woodrat is the construction of setback levees. These adverse effects would be minimized through implementation of AMM1–AMM7, AMM10, and AMM25.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1A would avoid the potential for substantial effects on riparian woodrats, either indirectly or through habitat modifications, or result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Therefore, indirect effects of Alternative 1A would not have an adverse effect on riparian woodrat.

CEQA Conclusion: Should riparian woodrat be detected in the study area, indirect effects of conservation measure construction and implementation could impact this species and its habitat. AMM1–AMM7, AMM10, and AMM25 implemented under Alternative 1A would avoid and minimize the impact and result in a less-than-significant impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian woodrat habitat. Floodplain restoration would result in periodic inundation of up to 203 acres of riparian woodrat habitat (9% of the riparian woodrat habitat in the Plan Area). The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of moderate-value habitat for the species. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have been detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River and there are two species occurrences immediately south of CZ 7, one of which is less than 1 mile from the southernmost patch of riparian habitat potentially affected by levee construction. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more).

NEPA Effects: Alternative 1A's periodic inundation of 203 acres of riparian habitat for riparian woodrat is not expected to result in substantial adverse effects on riparian woodrat, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrat. The effects of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation. Therefore, the periodic inundation of riparian woodrat habitat would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect a total of 203 acres of riparian habitat for riparian woodrat, representing 9% of the 2,166 acres of modeled riparian woodrat habitat in the study area. The impact of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation, as described in AMM25. Implementation of CM5 would not be expected to result in significant impacts on riparian woodrat, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Periodic inundation of riparian woodrat habitat under Alternative 1A would have a less-than-significant impact.

Salt Marsh Harvest Mouse

The habitat model used to assess effects on the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Construction and restoration associated with Alternative 1A conservation measures would result in effects to modeled salt marsh harvest mouse habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species postrestoration) as indicated in Table 12-1A-57. All of the effects to the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of

Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit salt marsh harvest mouse (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary salt marsh harvest mouse habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect and enhance at least 1,500 acres of managed wetland in Grizzly Island Marsh Complex for the benefit of salt marsh harvest mouse (Objective MWNC1.1, associated with CM3).
- Protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3 and CM8).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of restored or created middle and high marsh as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective SMHM1.1).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of managed wetland protected and enhanced in the Grizzly Island Marsh Complex as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California, and increase population levels above the current baseline (Objective SMHM1.2).

As explained below, with the restoration or protection of these amounts of habitat, in addition to AMMs to minimize potential effects, impacts on the salt marsh harvest mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-57. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	TBEW Primary	64	67	0	0	0	0
	TBEW Secondary	0	0	0	0	0	0
	Upland Secondary	8	9	0	0	0	0
	MW Wetland Primary	1,913	5,323	0	0	0	0
	MW Wetland Secondary	315	807	0	0	0	0
	MW Upland	165	762	0	0	0	0
Total Impacts CM2–CM18		**2,465**	**6,968**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**2,645**	**6,968**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
TBEW = tidal brackish emergent wetland
MW = managed wetland
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

Alternative 1A tidal restoration (CM4) would be the only conservation measure resulting in effects on salt marsh harvest mouse habitat. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: would result in effects to 6,968 acres of salt marsh harvest mouse modeled habitat, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. Salt marsh harvest mouse may be displaced temporarily from areas of converted habitat but these areas would ultimately provide suitable habitat for the species. However, 1,058 of these acres would be downgraded from primary habitat (67 acres of primary tidal brackish emergent wetland and 991 acres of primary managed wetland) to secondary tidal brackish emergent wetland. The hypothetical restoration footprints in Suisun Marsh overlap with 13 CNDDB records for salt marsh harvest mouse (California Department of Fish and

Wildlife 2013); however, the BDCP's conservation actions assume that all suitable habitat in Suisun Marsh is occupied by the species.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, the restoration of at least 1,500 acres of tidal brackish emergent wetland would be managed to provide viable habitat for salt marsh harvest mouse and the protection of 1,500 acres of managed wetland specifically to be managed for salt marsh harvest mouse. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas for salt marsh harvest mouse and may result in localized ground disturbances that could temporarily remove small amounts of salt marsh harvest mouse habitat. The restoration of tidal brackish emergent wetlands, the protection of manage wetlands, and the protection and/or restoration of grasslands within 200 feet of restored salt marsh harvest mouse habitat would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of salt marsh harvest mouse habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to salt marsh harvest mouse during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1A would effect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be from primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects to salt marsh harvest mouse.

Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh occurs gradually. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- Restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs. This phasing would ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there are no project level impacts to salt marsh harvest mouse from CM1, the analysis of the effects and conservation actions does not include a comparison to standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, and AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1A as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. These effects (loss and conversion) would be on 20% of the modeled habitat in the study area. Most of these effects (99%) would be to managed wetlands, which though are known to be occupied by salt marsh harvest mouse are at high risk of catastrophic flooding and have a lower long-term conservation value than tidal wetlands (U.S. Fish and Wildlife Service 2010). Effects on up to 20% of the species' habitat in the Plan Area may diminish the salt marsh harvest mouse population in the Plan Area and result in reduced genetic diversity, thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas.

The Plan includes a commitment to restore or create 6,000 acres to tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4), the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh occurs gradually. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

***NEPA Effects*:** In the absence of other conservation actions, the effects on salt marsh harvest mouse habitat from Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8 and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place during all project activities. Considering these commitments, losses and conversions of salt marsh harvest mouse habitat and potential mortality of individuals in both the near-term and late long-term under Alternative 1A would not be an adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of near-term covered activities would be less than significant under CEQA. Alternative 1A would impacts 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be to primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse). Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects to salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh occurs gradually. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there are no project level impacts to salt marsh harvest mouse from CM1, the analysis of the effects and conservation actions does not include a comparison to standard ratios used for project level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan,* and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work

areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1A as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. The Plan contains a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associate with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse are listed here.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh occurs gradually. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

Alternative 1A would result in substantial habitat modifications to salt marsh harvest mouse habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place during all project activities, Alternative 1A over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on salt marsh harvest mouse.

Impact BIO-159: Indirect Effects of Plan Implementation on Salt Marsh Harvest Mouse

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to salt marsh harvest mouse occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM6, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on salt marsh harvest mouse.

Tidal marsh restoration has the potential to increase salt marsh harvests mouse's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High tidal marsh is considered to be primary habitat for salt marsh harvest mouse and thus the species could be exposed to methyl mercury in tidal restoration areas. Salt marsh harvest mouse may be exposed to elemental mercury by feeding on pickleweed, which is found concentrated in the distal tips of pickleweed leaves (Yee et. al., 2008). Though elemental mercury is less bioavailable than methylmercury, studies have shown that mercury can become methylated in the anaerobic portions of the intestinal tract (Rudd et al. 1980, Rieder et al. 2013) and could thus become a pathway for salt marsh harvest exposure to methylmercury. A study of small mammals residing in pickleweed around the San Francisco Bay showed an absence of salt marsh harvest mouse where mercury concentrations measured in house mice (*Mus musculus*) livers were ≥0.19 µg/g (dry weight) (Clark et al. 1992). Clark et al (1992) also report that the lack of salt marsh harvest mouse at these locations are not the result of undetected habitat differences or are by chance. Clarke et al (1992) suggest that the absence of salt marsh harvest mouse at certain locations may be associated with higher amounts of mercury and polychlorinated biphenyls (PCBs); however, because their study didn't analyze contaminants in salt marsh harvest mouse and because (at that time) there was no data in the literature on contaminants in harvest mice, they could not make conclusions on these associations. Currently, it is unknown what the exact exposure pathways are or what tissue concentrations are harmful to the salt marsh harvest mouse.

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for salt marsh harvest mouse exposure to methylmercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on salt marsh harvest mouse resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1A would avoid and minimize indirect effects on salt marsh harvest mouse. These AMMs would also avoid and minimize effects that could substantially reduce the number of salt marsh harvest mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on salt marsh harvest mouse.

***CEQA Conclusion*:** Indirect effects from construction-related noise and visual disturbances could impact salt marsh harvest mouse within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment adjacent to salt marsh harvest mouse habitat could also impact the species. With implementation of AMM1–AMM5, and AMM26 as part of Alternative 1A construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on salt marsh harvest mouse, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse. The indirect effects of Alternative 1A would have a less-than-significant impact on salt marsh harvest mouse.

Salt marsh harvest mouse could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse, and, therefore, would have a less-than-significant impact on the species.

Suisun Shrew

Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model. Construction and restoration associated with Alternative 1A conservation measures would result in effects to modeled Suisun shrew habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species postrestoration) as indicated in Table 12-1A-58. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area.

Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP to benefit Suisun shrew (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary Suisun shrew habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (TBEWNC2.1).
- Protect or restore grasslands adjacent t restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area, which provides refugia during high tides (GNC1.4, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, impacts on the Suisun shrew would not be adverse for NEPA purposes and would be less than significant for CEQA Alternative 1A.

Table 12-1A-58. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	Primary	58	60	0	0	0	0
	Secondary	47	342	0	0	0	0
Total Impacts CM2–CM18		**105**	**401**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**105**	**401**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun Shrew

BDCP tidal restoration (CM4) would be the only conservation measure resulting in loss of habitat to Suisun shrew. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: would result in effects on 401 acres of Suisun shrew modeled habitat, which would include 377 acres of permanent losses and 24 acres of habitat conversions. Suisun shrew may be displaced temporarily from areas of converted habitat but would ultimately provide suitable habitat for the species. However, all 24 acres would be converted from secondary to primary habitat and therefore over would be net benefit to the species. The hypothetical restoration footprints overlap with two CNDDB records for Suisun shrew (California Department of Fish and Wildlife 2013).
- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, the restoration of at least 6,000 acres of tidal brackish emergent wetland would be managed to provide habitat for covered species, including Suisun shrew. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas may result in localized ground disturbances that could temporarily remove small amounts of Suisun shrew habitat. The areas of grasslands that would be protected and/or restored within 200 feet of restored tidal marsh would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of

nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of Suisun shrew habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to Suisun shrew during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMM listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1A would effect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects to Suisun shrew.

Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there are no project level impacts to Suisun shrew from CM1, the analysis of the effects and conservation actions does not include a comparison to standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1A as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area).

The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

NEPA Effects: In the absence of other conservation actions, the effects on Suisun shrew habitat from Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8 and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction phase. Considering these commitments, losses and conversions of Suisun shrew habitat and potential mortality of individuals in both the near-term and late long-term under Alternative 1A would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of near-term covered activities would be less than significant under CEQA. Alternative 1A would impact 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These impacts include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet would likely benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and impacts on Suisun shrew.

Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there are no project level impacts to Suisun shrew from CM1, the analysis of the effects and conservation actions does not include a comparison to standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement AMM1–AMM5 and AMM26. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1A as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan contains a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

Alternative 1A would result in substantial modifications to Suisun shrew habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place during all project activities, Alternative 1A over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on Suisun shrew.

Impact BIO-161: Indirect Effects of Plan Implementation on Suisun Shrew

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to Suisun shrew occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5 and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect Suisun shrew and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills occurring and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on Suisun shrew.

Tidal marsh restoration has the potential to increase Suisun shrew's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High and mid tidal marsh is considered to be primary habitat for Suisun shrew and thus the species could be exposed to methylmercury in tidal restoration areas. Suisun shrew could be exposed to methylmercury by feeding on marsh invertebrates that may bioaccumulate methylmercury from marsh sediments. Toxic concentrations of methylmercury have been found in the kidneys of shrews that inhabit contaminated sites and forage on earthworms and other prey that live within contaminated sediments (Talmage and Walton 1993; Hinton and Veiga 2002).

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for Suisun shrew exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on Suisun shrew resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1A would avoid and minimize the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of Suisun shrew, or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on Suisun shrew.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact Suisun shrew within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact Suisun shrew and its habitat. The inadvertent discharge of sediment adjacent to Suisun shrew habitat could also impact the species. With implementation of AMM1–AMM5 and AMM26 as part of Alternative 1A construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew. The indirect effects of Alternative 1A would have a less-than-significant impact on Suisun shrew.

Suisun shrew could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew, and, therefore, would have a less-than significant impact on the species.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7– CZ 10.

The study area represents the extreme northeastern corner of San Joaquin kit fox's range in California, which extends westward and southward from the Plan Area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013) reports eight occurrences of San Joaquin kit foxes along the extreme western edge of the Plan Area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of San Joaquin kit fox and American badger habitat (Table 12-1A-59). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin kit fox habitat and potential American badger habitat. Full implementation of Alternative 1A would also include biological objectives over the term of the BDCP to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the Plan Area; and providing connectivity to habitat outside the Plan Area. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in CZ 1, CZ 8, and/or CZ 11 (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Protect 600 acres of existing vernal pool complex in CZ 1,CZ 8, and CZ 11, primarily in core vernal pool recovery areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration) (Objective VPNC1.2, associated with CM3 and CM9).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.4, associated with CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.4, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.5, associated with CM11).

- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the implementation of AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-59. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Grassland	173	173	167	167	NA	NA
Total Impacts CM1		**173**	**173**	**167**	**167**	**NA**	**NA**
CM2–CM18	Grassland	3	8	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**176**	**181**	**167**	**167**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 1A would result in the permanent and temporary loss combined of up to 348 acres of modeled habitat for the San Joaquin kit fox (Table 12-1A-59). Because American badger uses grasslands for denning and foraging may occupy the same range as the San Joaquin kit fox in the project area, effects on are anticipated to be the same as those described for San Joaquin kit fox. Construction of Alternative 1A water conveyance facilities (CM1) and recreation facilities (CM11) would remove habitat. Habitat enhancement and management activities (CM11) could result in local adverse effects on species. In addition, construction vehicle activity could cause injury or mortality of San Joaquin kit foxes and badgers. Each of these individual activities is described below. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions

- *CM1 Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 173 acres and the temporary loss of 167 acres of modeled San

Joaquin kit fox habitat and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8.

- *CM11 Natural Communities Enhancement and Managemen*t: The creation of recreational trails and recreational staging areas would result in the permanent removal of 8 acres of San Joaquin kit fox modeled habitat and American badger potential habitat. *AMM24 San Joaquin Kit Fox,* would be implemented to ensure that San Joaquin kit fox dens are avoided, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Mitigation Measure BIO-162*: Conduct Preconstruction Survey for American Badger* would be implemented to ensure that American badger dens are avoided.

  Passive recreation in the reserve system could result in disturbance of San Joaquin kit foxes and American badgers at their den site. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox dens and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox and American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox or American badger populations. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

  The BDCP would require the protection of grasslands in large patch sizes connected to existing large areas of grassland, habitat corridors and transition habitat areas to improve the ecological functions of the grasslands necessary to support the San Joaquin kit fox. American badger is expected to benefit in a similar fashion.

  The BDCP would require the enhancement and management of these protected existing grasslands and restored grasslands to improve their function as a natural community of plants and wildlife and for associated covered species, including San Joaquin kit fox. The BDCP also includes actions to improve rodent prey availability.

  However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs and mitigation measure listed below. These AMMs and mitigation measure would remain in effect throughout the BDCP's construction phase.

- Operations and maintenance: Ongoing maintenance of BDCP facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, and AMM24 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Under Alternative 1A there would be a loss of 343 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (340 acres) and CM11 (3 acres).

Typical NEPA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 686 acres of grassland should be protected for San Joaquin kit fox to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 686 acres of grassland protected.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the effects of Alternative 1A would not be adverse with habitat protection, restoration, management, and enhancement in addition to implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation*. These AMMs contain elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and disposal sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 348 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger, representing 6% of the modeled habitat.

With full implementation of Alternative 1A, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the study area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the study area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for both species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1) and to other adjoining San Joaquin kit fox habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badgers, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A, *Covered Species Accounts*). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in

Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

NEPA Effects: In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-162, the effects of Alternative 1A as a whole on San Joaquin kit fox and American badger would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects under CEQA would be less than significant.

Under Alternative 1A there would be a loss of 343 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (340 acres) and CM11 (3 acres).

Typical CEQA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 686 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on San Joaquin kit fox and American badger. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for San Joaquin kit fox and the mitigation measure for American badger satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1–6, AMM10, AMM24, and AMM37 which include elements that avoid or minimize the risk of construction activity impacting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1A on San Joaquin kit fox and American badger would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 686 acres of grassland protected.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1A as a whole would result in the permanent and temporary loss of 348 acres of modeled habitat for San Joaquin kit fox, and potential habitat for American badger representing 6% of the modeled habitat.

With full implementation of Alternative 1A, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the study area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the study area (6.8% of the grasslands in the study area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for the species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1) and to other adjoining San Joaquin kit fox habitat and American badger within and adjacent to the study area. Connectivity to occupied habitat adjacent to the study area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the study area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A, *Covered Species Accounts*). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 1A as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project-related conservation areas within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Plan Implementation on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facilities, the potential for this effect is small. The effect would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, and other measures as described in AMM1–AMM6, AMM10, AMM24, and AMM37 and Mitigation Measure BIO-162.

***NEPA Effects*:** Implementation of the AMMs listed above and Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger,* would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on San Joaquin kit fox or American badger.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 1A construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. In addition, Mitigation Measure BIO-162 would reduce the impact of indirect effects of Alternative 1A on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

This section describes the effects of Alternative 1A, including water conveyance facilities construction and implementation of other conservation components, on San Joaquin pocket mouse. Habitat for this species consists of the grassland natural community throughout the Plan Area. The species requires friable soils for burrowing.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-1A-60. Full implementation of Alternative 1A would also include the following conservation actions over the term of the BDCP that would likely benefit San Joaquin pocket mouse.

- Protect 8,000 acres of grasslands (GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grasslands (GNC1.2, associated with CM8).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (GNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, impacts to San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes for Alternative 1A.

Table 12-1A-60. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 1A (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Grassland	315	315	262	262	NA	NA
Total Impacts CM1		**315**	**315**	**262**	**262**	**NA**	**NA**
CM2–CM18	Grassland	889	2,056	239	273	385–1,277	514
Total Impacts CM2–CM18		**889**	**2,056**	**239**	**273**	**385–1,277**	**514**
TOTAL IMPACTS		**1,204**	**2,371**	**501**	**535**	**385–1,277**	**514**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 1A conservation measures would result in the combined permanent and temporary loss of up to 2,906 acres of habitat for San Joaquin pocket mouse (of which 2,371 acres would be a permanent loss and 535 acres would be a temporary loss of habitat, Table 12-1A-60). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*. The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the combined permanent and temporary loss of up to 577 acres of potential San Joaquin pocket mouse habitat (315 acres of permanent loss, 262 acres of temporary loss) in CZ 3-CZ 6 and CZ 8. The majority of grassland that would be removed would be in CZ 8, from the construction around Clifton Court Forebay. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1A construction locations. Construction of the forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Wildlife 2013).

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement (CM2) would permanently remove 388 acres of potential San Joaquin pocket mouse habitat in the Yolo Bypass in CZ 2. In addition, 239 acres would be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels.
- *CM4 Tidal Habitat Restoration*: Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 1,122 acres of potential San Joaquin pocket mouse habitat. The majority of the losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment remaining grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain (CM5) would permanently and temporarily remove approximately 85 acres of San Joaquin pocket mouse habitat (51 permanent, 34 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would impact 410 acres of grasslands, primarily in C Z7, as part of tidal natural communities restoration (11 acres) and seasonal floodplain restoration (399 acres).
- *CM9 Verna Pool and Alkali Seasonal Wetland Complex Restoration*: Up to 10 acres of grassland would be permanently converted to vernal pool complex. The vernal pool and alkali seasonal wetland restoration would leave intact the grasslands surrounding the vernal pools. Temporary construction-related disturbance of grassland habitat would result from implementation of *CM9* in CZ 1, CZ 8, and CZ 11. However, all areas would be restored to their original or higher value habitat after the construction periods.
- *CM11 Natural Communities Enhancement and Management*: The creation of recreational trails and recreational staging areas would result in the permanent removal of 50 acres of grassland. The protection of 8,000 acres of grassland for covered species is also expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.

  A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. With full implementation of the BDCP, enhancement and management actions designed for western burrowing owl would also be expected to benefit these species. San Joaquin pocket mouse would benefit particularly from protection of grassland habitat against potential loss or degradation that otherwise could occur with future changes in existing land use.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of San Joaquin pocket mouse habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1A would remove 1,714 acres of San Joaquin pocket mouse habitat (1,204 permanent, 371 temporary) in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 577 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Riparian Natural Community Restoration (CM7), Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], Natural Community Enhancement and Management – Recreation Facilities (CM11), and Conservation Hatcheries [CM18] 1,128 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,154 acres of grassland natural communities should be protected to mitigate the CM1 losses of 577 acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of San Joaquin pocket mouse habitat using the same typical NEPA and CEQA ratios (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 especially considering that a large portion of the impacts to grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporary Impacts.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 2,906 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, 8 and 11 (GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, 2, 4, 5, 7, 8, and 11 in the study area)(GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

NEPA Effects: In the near-term, the loss of San Joaquin pocket mouse habitat and potential for direct mortality would not be adverse because the BDCP has committed to protecting and restoring an acreage that would meet the typical mitigation ratios described above. In the late long-term, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 1A would represent an adverse effect in the absence of other conservation actions. However, the BDCP has committed to habitat protection and restoration associated with CM3, CM8, and CM11. This habitat protection and restoration would be guided by biological goals and objectives and by AMM1–AMM6 and AMM10, which would be in place during construction activity. Considering these commitments, losses of San Joaquin pocket mouse habitat and potential mortality under Alternative 1A would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1A would remove 1,714 acres of modeled (1,204 permanent, 371 temporary) habitat for San Joaquin pocket mouse in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 577 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Riparian Natural Community Restoration (CM7), Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], Natural Community Enhancement and Management – Recreation Facilities (CM11), and Conservation Hatcheries [CM18] 1,128 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,154 acres of grassland natural communities should be protected to mitigate the CM1 losses of 577 acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of San Joaquin pocket mouse habitat using the same typical NEPA and CEQA ratios (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 especially considering that a large portion of the impacts to grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities Temporary Impacts*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1A would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 1A as a whole would result in the permanent loss of and temporary effects on 2,906 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8 and CZ 11 (Objective GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area) (Objective GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (Objective GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the Plan Area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM6, and AMM10, the loss of habitat or direct mortality through implementation of Alternative 1A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Impact BIO-165: Indirect Effects of Plan Implementation on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat over the term of the BDCP. These potential effects would be minimized and avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the plan's construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

NEPA Effects: Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on San Joaquin pocket mouse.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6, and AMM10 as part of Alternative 1A construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report* for details on methods and results, and Table 12A-2 in Appendix 12A).

The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat, At the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Construction and restoration associated with Alternative 1A conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-1A-61. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. The conservation measures that would be implemented to achieve the biological goals and objectives that would also benefit special-status bats are summarized below.

- Protect or restore 142,200 acres of high-value natural communities (Objective L1.1, associated with CM3). This objective includes protecting and restoring a variety of habitat types described below (Table 3.3-4 in BDCP Chapter 3).
    - Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
    - Protect 600 acres of existing vernal pool complex (Objective VPNC1.1, associated with CM3).
    - Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
    - Protect 8,100 acres of managed wetland (Objective MWNC1,1, associated with CM3 and CM11).
    - Protect 48,625 acres of cultivated lands (Objective CLNC1.1, associated with CM3 and CM11).
    - Protect, restore, or create 2,740 acres of rice land or equivalent habitat type for the giant garter snake (Objective GGS3.1, associated with CM3, CM4, and CM10).
    - Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
    - Restore 67 acres of vernal pool complex (Objective VPNC1.2, associated with CM3 and CM9).
    - Restore and protect 65,000 acres of tidal natural communities (Objective L1.2, associated with CM2, 3, and 4).
    - Restore or create 5,000 acres of valley/foothill riparian natural community (Objective VFRNC1.1, associated with CM3 and CM7).
    - Protect 750 acres of existing valley/foothill riparian natural community in C Z7 by year 10 (Objective VFRNC1.2, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1A-61. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 1A[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Roosting	220	220	213	213	NA	NA
	Foraging	4,389	4,389	2,782	2,782	NA	NA
Total Impacts CM1		**4,609**	**4,609**	**2,995**	**2,995**	**NA**	**NA**
CM2–CM18	Roosting	524	1,570	167	212	324	411
	Foraging	14,497	60,399	773	2,126	21,265	10,137
Total Impacts CM2–CM18		**15,021**	**61,969**	**940**	**2,338**	**21,589**	**10,548**
TOTAL IMPACTS		**19,630**	**66,577**	**3,935**	**5,333**	**21,589**	**10,548**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Affected roosting habitat acreages include valley/foothill riparian habitat, developed lands, and orchards. An unknown number of buildings, bridges, tunnels, and individual trees could also be affected but were not included in this analysis. Foraging habitat includes all natural communities, cultivated lands, and developed lands in the study area. Foraging habitat effects for CM2-CM18 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands).

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as the maximum possible based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 1A CM1 would result in the permanent and temporary loss combined of up to 433 acres of roosting habitat and 7,171 acres of foraging habitat for special-status bats in the study area. DWR identified one bridge as potential night roosting habitat that could be affected by construction in CM1. Conservation measures Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5) and would result in the permanent and temporary loss of 1,782 acres of roosting habitat and the conversion of approximately 65,525 acres of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Habitat enhancement and management activities (CM11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect special-status bat habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1A conveyance facilities would result in the permanent loss of approximately 220 acres of roosting habitat and 4,389 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 213 acres of roosting habitat and up to 2,782 acres of foraging habitat for special-status bats in the study area (Table 12-1A-61). DWR identified one bridge with potential night roosting habitat in a shaft location that could be permanently affected by construction for CM1.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the conversion of approximately 2,025 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM2 would also result in the permanent removal of 89 acres and temporary removal of 167 acres of roosting habitat for special-status bats. The maternity colony of Mexican free-tailed bats located at both ends of the Yolo Causeway bridge could also be affected during construction for CM2. Implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would ensure that improvements in the Yolo Bypass avoid effects on roosting special-status bats.

- C*M4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of approximately 56,810 acres of foraging habitat into wetlands that could still be used by bats for foraging. Approximately 1,425 acres of roosting habitat for special-status bats would permanently affected. This habitat is of low value, consisting of a small, isolated patch surrounded by cultivated lands, and the species have a relatively low likelihood of being present in these areas. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, requires that tidal natural communities restoration avoid effects on roosting special-status bats.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the conversion of an estimated 3,690 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM5 would also result in the permanent removal of 57 acres and temporary removal of 45 acres of roosting habitat for special-status bats in the study area.

- *CM11 Natural Communities Enhancement and Management*: Implementation of Alternative 1A would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.

- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to conservation components could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 1A would permanently or temporarily affect 1,124 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (433 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 561 acres of the 1,124 acres of roosting habitat losses would be in valley/foothill riparian habitat.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 561 acres of riparian habitat should be restored and 561 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1A.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these effects.

The BDCP also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1A as a whole would affect 2,215 acres of roosting habitat (Table 12-1A-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of Alternative 1A in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

NEPA Effects: Because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above, the losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 1A are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. With habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, and AMM10, and with implementation of Mitigation Measure BIO-166, loss of habitat and potential mortality under Alternative 1A as a whole would not have an adverse effect on special-status bats.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 1A would permanently or temporarily affect 1,124 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (433 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 561 acres of the 1,124 acres of roosting habitat losses would be in valley/foothill riparian habitat.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 561 acres of riparian habitat should be restored and 561 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1A. In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these impacts to less than significant under CEQA.

The permanent loss of roosting habitat from Alternative 1A would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The BDCP also contains commitments to implement AMM1–6 and AMM10. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1A as a whole would affect 2,215 acres of roosting habitat (Table 12-1A-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

The permanent loss of roosting habitat from Alternative 1A would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure that there is no significant impact on roosting special-status bats, either directly or through habitat modifications, and that there is no substantial reduction in numbers or a restriction in the range of special-status bats. Therefore, Alternative 1A would not result in a significant impact on special-status bats under CEQA.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures will be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined by DWR in consultation with CDFW and shall include, as applicable, the measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.

- Disturbance of the bridge will be avoided between March 1 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bat species that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal will be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 31, later tree removal may be considered in consultation with CDFW.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent feasible and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction will be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:
    - Eviction would not occur before September 15th and would match the timeframe for tree removal approved by CDFW.
    - Qualified biologists would carry out or oversee the eviction tasks and would monitor the tree trimming/removal.
    - Eviction would take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
    - Eviction would take place during weather and temperature conditions conducive to bat activity.
    - Special-status bat roosts would not be disturbed.

  Eviction procedures shall include but are not limited to:

    - Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.

- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Non-injurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat will also be determined through consultation with CDFW and may include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, “bat bark,” planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. “Bat bark” has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-wouldow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Plan Implementation on Special-Status Bats

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat over the term of the BDCP.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these potential effects.

Increased exposure to methylmercury associated with tidal natural communities restoration could indirectly affect special-status bat species. *CM12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *CM12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from BDCP tidal natural communities restoration.

NEPA Effects: Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 1A would not have an adverse effect on special-status bats.

CEQA Conclusion: Indirect effects from conservation components operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166 would reduce this impact to a less-than-significant level and ensure Alternative 1A would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 324 acres of roosting habitat and 21,265 acres of foraging habitat for special-status bats in the study area (Table 12-1A-61).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate up to 411 acres of roosting habitat and 10,137 acres of foraging habitat for special-status bats (Table 12-1A-61). Potential roosting trees are likely to be retained within seasonally flooded areas, although high velocity flooding could uproot some trees. Seasonal flooding would not adversely affect foraging habitat for the species. The overall effect of seasonal inundation in existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for special-status bats that use riparian habitats.

NEPA Effects: The periodic losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 1A are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address any effects of periodic inundation on special-status bats and roosting habitat. Therefore, Alternative 1A would not adversely affect the species.

***CEQA Conclusion*:** Periodic inundation under CM2 and floodplain restoration under CM5 would periodically affect foraging and roosting habitat for special-status bats in the study area. Any impact of periodic inundation on special-status bats would be mitigated through implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Plant Species

Vernal Pool Plants

Five covered plant species and 12 noncovered special-status plant species occur in vernal pools in the study area (Tables 12-2, 12-3, summarized in Table 12-1A-62). The vernal pool habitat model used for the impact analysis was based on vegetation types and associations from various data sets which were used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which these species are known to occur, including vernal pool complex, degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 1A.

Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit covered vernal pool plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Objective VPP1.1, associated with CM3).
- Maintain no net loss of Heckard's peppergrass in Conservation Zones 1, 8, or 11 within restoration sites or within the area of affected tidal range of restoration projects (Objective VPP1.2, associated with CM3 and CM9).

The construction and restoration activities covered under Alternative 1A could have impacts on special-status vernal pool plants. No modeled habitat and no known occurrences of the 17 vernal pool plants are within the proposed footprint for the Alternative 1A water conveyance facilities. No known occurrences of the 17 vernal pool plants are within the hypothetical footprint for restoration activities; however, modeled vernal pool habitat is present within the tidal restoration footprint. Table 12-1A-62 summarizes the acreage of modeled vernal pool habitat in the study area, the number of occurrences of each special-status vernal pool plant in the study area, and potential impacts.

Table 12-1A-62. Summary of Impacts on Vernal Pool Plants under Alternative 1A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Vernal pool complex	9,557	2	0	0	Habitat loss from construction of water conveyance facilities and tidal habitat restoration
Degraded vernal pool complex	2,576	373	0	0	Habitat loss from construction of water conveyance facilities and tidal habitat restoration
Alkali Seasonal Wetland	188	0	0	0	None
Total	**12,321**	**375**	**0**	**0**	Habitat loss from construction of water conveyance facilities and tidal habitat restoration
Covered Species					
Alkali milk-vetch	0	0	16	0	None
Dwarf downingia	0	0	12	0	None
Boggs Lake hedge-hyssop	0	0	1	0	None
Legenere	0	0	8	0	None
Heckard's peppergrass	0	0	4[a]	0	None
Noncovered Species					
Ferris' milk-vetch	0	0	6	0	None
Vernal pool smallscale	0	0	2	0	None
Hogwallow starfish	0	0	0	0	None
Ferris' goldfields	0	0	4	0	None
Contra Costa goldfields	0	0	7	0	None
Cotula-leaf navarretia	0	0	5	0	None
Baker's navarretia	0	0	3	0	None
Colusa grass	0	0	1	0	None
Bearded popcorn-flower	0	0	5	0	None
Delta woolly marbles	0	0	3	0	None
Saline clover	0	0	9	0	None
Solano grass	0	0	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Alternative 1A covered activities could affect habitat for special-status vernal pool plants. The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Three acres of modeled habitat for covered vernal pool species are present within the proposed footprint for the Alternative 1A water conveyance facilities. No known occurrences of the 17 vernal pool plants are within the proposed footprint for the Alternative 1A water conveyance facilities. However, under Alternative 1A, construction and operation of the water conveyance facilities could affect undiscovered occurrences of the five covered vernal pool plants or the 12 noncovered special-status plants.
- *CM2 Yolo Bypass Fisheries Enhancement*: No modeled vernal pool habitat and no known occurrences of special-status vernal pool plant species are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Construction and operation of the Yolo Bypass Fisheries enhancements would not affect the 17 covered or noncovered vernal pool plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit covered vernal pool plants by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1). The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species. These benefits also would accrue to any noncovered vernal pool plants occurring in the protected vernal pool complex.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would result in the inundation of 372 acres of vernal pool complex and would, therefore, potentially affect special-status vernal pool plants. However, most of this habitat (370 acres) consists of degraded vernal pool habitat that is unlikely to contain special-status plants. In addition, 257.8 acres of critical habitat for Contra Costa goldfields could be affected. No known occurrences of covered and noncovered vernal pool plants would be affected.
- *CM5 Seasonally Inundated Floodplain Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered vernal pool plants.
- *CM6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM8 Grassland Natural Community Restoration*: Although the vernal pool complex habitat includes grassland matrix within which the vernal pools occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands

that are not included within vernal pool complex habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered vernal pool plants.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, BDCP activities result in the net loss of vernal pool habitat, CM9 would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plants would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool plants or potentially affect vernal pool habitat adjacent to the restoration areas.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on covered and noncovered vernal pool plants.
- *Avoidance and Minimization Measures*: Effects on covered vernal pool plants potentially resulting from implementation of CM4 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring*, *AMM12 Vernal Pool Crustaceans*, and *AMM37 Recreation*. AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. AMM12 also requires that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields where it overlaps with critical habitat for these vernal pool crustaceans. AMM37 requires that new recreation trails avoid populations of covered vernal pool plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In addition, the BDCP includes species-specific goals to benefit covered vernal pool plants. This includes protecting two occurrences of alkali milkvetch (Objective VPP1.1) and requiring no net loss of Heckard's peppergrass (Objective VPP1.2).

In summary, no adverse effects on covered special-status vernal pool plants would be expected under Alternative 1A. No known occurrences of 17 special-status vernal pool plants would be affected. Beneficial effects on special-status vernal pool plants could occur by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 and by protecting occurrences of alkali milk-vetch. Because conservation measures that protect covered species do not apply to noncovered species, one occurrence of bearded popcornflower could be adversely affected.

The GIS analysis estimated that up to 375 acres of vernal pool complex could be adversely affected by covered activities under Alternative 1A. However, the actual effect on habitat for special-status vernal pool plants is expected to be much less than the estimated impact because the BDCP limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants (Objective VPNC1.2, associated with CM9). This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts. The limitation on the loss of wetted vernal pool habitat will constrain the implementation of tidal restoration projects that are adjacent to vernal pool complex, which could affect the feasibility of restoring 65,000 acres of tidal habitat (Objective TPANC1.1, associated with CM4).

NEPA Effects: The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through CM9. Therefore, Alternative 1A would not result in adverse effects on covered and noncovered vernal pool plant species.

CEQA Conclusion: Because loss of modeled habitat for vernal pool plants would be offset through restoration, and because impacts on occurrences of covered vernal pool plants would be avoided, implementation of Alternative 1A would not result in a reduction in the range or numbers of 17 covered and noncovered special-status vernal pool plants in the study area. This impact would be less than significant, and no mitigation is required.

Alkali Seasonal Wetland Plants

Five covered species and three noncovered plants occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1A-63). Alkali seasonal wetland habitat was modeled separately for four covered plant species occurring in seasonal alkali wetlands.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the Plan Area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit covered alkali seasonal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Of the 150 acres of alkali seasonal wetland complex protected under Objective ASWNC1.1, 600 acres of vernal pool complex protected under Objective VPNC1.1, and 8,000 acres of grassland natural community protected under Objective GNC1.1, protect 75 acres of suitable brittlescale habitat and 75 acres of suitable heartscale habitat in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.1, associated with CM3).
- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.2, associated with CM3).

Modeled habitat for Delta button-celery would be adversely affected by construction of the Alternative 1A water conveyance facilities. One population of crownscale also would be adversely affected by construction of the water conveyance facilities. Modeled habitat for brittlescale and heartscale could be adversely affected by tidal habitat restoration. One occurrence each of San Joaquin spearscale and Heckard's peppergrass could be affected by tidal habitat restoration. No adverse effects on palmate-bracted bird's-beak or recurved larkspur would be expected. Table 12-1A-63 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland plant in the study area.

Table 12-1A-63. Summary of Impacts on Seasonal Alkali Wetland Plants under Alternative 1A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	748	0	0	Habitat loss from construction of water conveyance facilities, construction of Yolo Bypass fisheries enhancements, tidal habitat restoration, and floodplain restoration levee construction
Brittlescale modeled habitat	451	4	0	0	Habitat loss from tidal habitat restoration
Heartscale modeled habitat	6,528	306	0	0	Habitat loss from tidal habitat restoration
Delta button-celery modeled habitat	3,361[a]	18	0	0	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	72	0	0	Habitat loss from tidal restoration and Yolo Bypass fisheries enhancements
Covered Species					
San Joaquin spearscale	0	0	19	1	Population loss from tidal habitat restoration
Brittlescale	0	0	8	0	None
Heartscale	0	0	3	0	None
Delta button celery	0	0	1[b]	0	None
Heckard's peppergrass	0	0	1[c]	1	Population loss from tidal habitat restoration
Noncovered Species					
Crownscale	0	0	17	1	Population loss from construction of water conveyance facilities
Palmate-bracted bird's-beak	0	0	1	0	None
Recurved larkspur	0	0	4	0	None

[a] portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Two additional occurrences of Heckard's peppergrass are associated with vernal pools.

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Alternative 1A would have adverse effects on modeled habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. It would also have adverse effects on occurrences of heartscale, Heckard's peppergrass, and crownscale.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Under Alternative 1A, construction of the Byron Tract Forebay would permanently remove 69 acres of modeled habitat for San Joaquin spearscale and 21 acres of modeled habitat for Delta button-celery. This could be an adverse effect, depending on whether or not the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Known occurrences of San Joaquin spearscale near the forebay do not appear to be affected by facilities construction. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected.

  Construction of the water conveyance facilities would permanently remove 0.2 acre of habitat occupied by crownscale at the Byron Tract Forebay. Part of the occurrence would be removed, but most of the occurrence would not be directly affected. However, a reduction of the population size, both in area and number of individuals present, would be an adverse impact.

  Construction of the water conveyance facilities would not affect brittlescale, heartscale, Heckard's peppergrass, palmate-bracted bird's-beak, or recurved larkspur.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would permanently remove 56 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No modeled habitat and no known occurrences of the seven other alkali seasonal wetland plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.

- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, and/or 11. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration is expected to convert alkali seasonal wetlands on the margins of tidal wetlands to freshwater or brackish tidal marsh. Tidal habitat restoration would convert 622 acres of modeled habitat for San Joaquin spearscale to tidal marsh. Tidal habitat restoration would permanently remove 4 acres of modeled habitat for brittlescale in CZ 1 near Lindsey Slough and in CZ 11 near Nurse Slough; however, the BDCP would allow up to 50 acres of modeled habitat to be converted to tidal wetlands. Tidal habitat restoration would remove 306 acres of modeled habitat for heartscale in CZ 1 in the vicinity of Jepson Prairie and in CZ 11 adjacent to Suisun Marsh. The extent to which the modeled habitat is actually occupied by these species is not known; modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Tidal habitat restoration could adversely affect an occurrence of Heckard's peppergrass at Hass Slough and an occurrence of San Joaquin spearscale at Main Prairie, both in CZ 1. These occurrences are based on historic records, and the whether or not the populations still exist is not known. In each case, the loss of modeled habitat and occurrences for covered species would be adverse effects. Delta button celery, crownscale, palmate-bracted bird's-beak, and recurved larkspur would not be affected by tidal habitat restoration.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the removal of 2 acres of modeled habitat for San Joaquin spearscale. In addition, 3 acres would be subject to periodic flooding. No known occurrences of San Joaquin spearscale would be affected. No other alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM8 Grassland Natural Community Restoration*: Although the alkali seasonal wetland habitat includes the grassland matrix within which the wetlands occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within alkali seasonal wetland habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants. In addition, the BDCP would compensate for the loss of alkali seasonal wetlands from other CMs by restoring or creating 72 acres of alkali seasonal wetlands in Conservation Zones 1, 8, or 11 to achieve no net loss of this habitat.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *Avoidance and Minimization Measures*: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of CM1 and CM4 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of covered species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM37 requires that new recreation trails avoid populations of covered alkali seasonal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, only one known occurrence of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 1A, although one historic occurrence of Heckard's peppergrass and one historic occurrence of San Joaquin spearscale could also be affected by tidal restoration activities, if those occurrences still exist. AMM11 would be implemented to avoid an adverse effect on Heckard's peppergrass and San Joaquin spearscale occurrences.

The primary effect of Alternative 1A on special-status alkali seasonal wetland plants would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. Approximately 72 acres of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland plants is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the BDCP limits the total loss of wetted vernal pool habitat to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex (Objective VPNC1.2, associated with CM9). Approximately 72 acres of alkali seasonal wetlands would be restored (Objective ASWC1.2, associated with CM9). Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis (Objective GNC1.1, associated with CM8). These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

The BDCP would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland habitat. The BDCP also includes the species-specific goal that 75 acres would be modeled habitat for brittlescale and heartscale (Objective BRIT/HART/SJSC1.1) and another goal that would protect 2 occurrences of San Joaquin spearscale (Objective BRIT/HART/SJSC1.2). The benefits of habitat protection and management also would accrue to any noncovered alkali seasonal wetland plants occurring in the protected habitat.

NEPA Effects**:** Under Alternative 1A, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (CM8, CM9), and impacts on one occurrence of San Joaquin spearscale and one occurrence of Heckard's peppergrass would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse.

CEQA Conclusion**:** Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of covered alkali seasonal wetland plants would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 1A would not result in substantially reducing the number or restricting the range of five covered and two noncovered plant species. However, conservation measures that benefit or protect covered species do not apply to noncovered species, and portions of the crownscale population at Byron Tract Forebay would be lost, which would be a significant impact. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plants, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppy and caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for the special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered plants if practicable. The purpose of these surveys will be to verify that the locations of special-status plants identified in previous record searches or surveys are extant, identify any new special-status plant occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plants will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of covered fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having noncovered special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasible through the establishment of 250-foot activity exclusion zones surrounding the periphery of occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be established according to a 250-foot buffer surrounding the periphery of each special-status plant species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.
- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of

the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Grassland Plants

One covered plant and 11 noncovered special-status plants occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-1A-64). The only covered plant species occurring in grassland is Carquinez goldenbush. Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extend of alluvium deposits in close proximity to the actual rivers/streams.

Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit covered grassland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect three unprotected occurrences of the Carquinez goldenbush in Conservation Zones 1 and/or 11 (Objective CGB1.1, associated with CM3).
- Maintain and enhance occupied Carquinez goldenbush habitat to slow erosion and reverse degradation from livestock grazing (Objective CGB1.2, associated with CM11).

Of 78,047 acres of grasslands in the study area, Alternative 1A would adversely affect 2,857 acres, including 4 acres that are modeled habitat for Carquinez goldenbush. For 10 of the plants, no known occurrences would be affected. One of five Parry's rough tarplant occurrences in the study area could be adversely affected by Alternative 1A. Table 12-1A-64 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland plant in the study area.

Table 12-1A-64. Summary of Impacts on Grassland Plants under Alternative 1A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	4	0	0	Habitat loss from tidal habitat restoration
Grassland	78,047	2,857	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, floodplain restoration, and construction of conservation hatcheries facilities
Covered Species					
Carquinez goldenbush	0	0	10	1	Occurrence affected by tidal restoration
Noncovered Species					
Big tarplant	0	0	5	0	None
Round-leaved filaree	0	0	2	0	None
Pappose tarplant	0	0	7	0	None
Parry's rough tarplant	0	0	5	1	Periodic inundation of one occurrence as a result of Yolo Bypass operations
Small-flowered morning-glory	0	0	0	0	None
Diamond-petaled poppy	0	0	1	0	None
Stinkbells	0	0	1	0	None
Fragrant fritillary	0	0	4	0	None
Gairdner's yampah	0	0	0	0	None
Streamside daisy[a]	0	0	1	0	None
Caper-fruited tropidocarpum	0	0	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified in the BDCP.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plant Species

Alternative 1A could have adverse effects on modeled habitat for Carquinez goldenbush. It could also have adverse effects on one occurrence of Carquinez goldenbush and one occurrence of Parry's rough tarplant. Although Alternative 1A would have no expected effects on known occurrences of the other special-status plant species that occur in grasslands, the loss of 2,857 acres of grassland would have the potential to adversely affect undocumented populations of special-status grassland species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland plants are within the proposed footprint for the Alternative 1A water conveyance facilities. About 578 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 1A, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland plants.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 627 acres of grassland habitat. Yolo Bypass operations would result in more frequent and longer inundation of 1,597 acres of grasslands in the Yolo Causeway (CZ 2) that include habitat for one occurrence of Parry's rough tarplant. Parry's rough tarplant is a summer-blooming plant that occurs in areas subject to occasional inundation during the wet season, such as swales and seasonal wetlands. Increasing the frequency or duration of inundation may decrease the distribution in some areas by making some conditions too wet but would also expand the distribution into areas that may currently be too dry. Overall, changing the frequency and duration of inundation in the area of this occurrence should not result in a substantial change in the range of numbers of Parry's rough tarplant. Construction and operation of the Yolo Bypass Fisheries enhancements would not affect modeled habitat for Carquinez goldenbush or known occurrences of other special-status grassland plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to preserve 8,000 acres of grassland habitat, some of which may contain modeled habitat for Carquinez goldenbush. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 1,122 acres of grassland habitat. Four acres of modeled habitat for Carquinez goldenbush along the eastern side of Suisun Marsh would be adversely affected, including part of one known occurrence. No other known occurrences of special-status grassland plants are within the hypothetical footprint of tidal restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of new floodplain levees would result in the loss of 85 acres of grassland habitat. Periodic inundation of the floodplain would affect 513 acres of grassland habitat, and another 399 acres of grassland habitat would be converted to riparian habitat. However, no modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for floodplain restoration, and the affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered grassland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status

grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered grassland plants.

- *CM7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered grassland plants.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would restore 2,000 acres of grassland habitat. Restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands. These areas do not currently provide habitat for special-status grassland plants. Therefore, grassland communities restoration would have no impacts on covered and noncovered grassland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plants would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on covered and noncovered grassland plants.
- *CM18 Conservation Hatcheries*: Construction of the conservation hatcheries would remove 35 acres of grassland habitat. The removed habitat would consist of ruderal herbaceous vegetation that would not be likely to provide habitat for special-status grassland plants. Therefore, construction of the conservation hatcheries would not be expected to affect special-status grassland plants.
- *Avoidance and Minimization Measures*: Effects on Carquinez goldenbush potentially resulting from implementation of CM4 and potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. AMM37 requires that new recreation trails would avoid populations of Carquinez goldenbush. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The primary effect of Alternative 1A on special-status grassland plants is the loss of potential (i.e., modeled) habitat for Carquinez goldenbush, including part of one known occurrence. Under AMM11, the occurrence would be surveyed to establish the population limits and to redesign the project to avoid affecting the population, to the extent feasible. Protecting three unprotected occurrences of Carquinez goldenbush (Objective CGB1.1, associated with CM3) and maintaining and enhancing occupied Carquinez goldenbush (Objective CGB1.2, associated with CM11) would compensate for any residual effects. One occurrence of Parry's rough tarplant would be affected by CM2, but the effect is not expected to be adverse. No known occurrences of the other special-status grassland plants would be affected.

The BDCP would have a potential beneficial effect on special-status grassland plants by protecting 8,000 acres of grassland habitat. To ensure that this habitat preservation would specifically benefit Carquinez goldenbush, the Plan proposes to protect at least three Carquinez goldenbush occurrences in CZs 1 and 11 that are currently not protected and to maintain and enhance occupied Carquinez goldenbush habitat. The preservation of modeled or potential habitat, together with avoidance and minimization of impacts on species occurrences, would reduce any effects of Alternative 1A implementation on covered grassland plants to a level that is no longer adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for Carquinez goldenbush would be offset through CM3, CM8, and CM11. Therefore, implementation of Alternative 1A would result in no adverse effects on special-status grassland plants.

***CEQA Conclusion*:** Because adverse effects on special-status grassland plant species would be avoided or compensated for, Alternative 1A would not result in substantially reducing the numbers or restricting the range of one covered or 11 noncovered special-status grassland plants, and this impact would be less than significant. No mitigation is required.

Valley/Foothill Riparian Plants

Two covered plants and two noncovered special-status plants occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-1A-65). The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit covered valley/foothill riparian plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and enhance two occurrences of delta button celery. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of delta button celery for a total of two occurrences within the restored floodplain habitat on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. (Objective DBC1.1, associated with CM3 and CM11).
- Protect and enhance two occurrences of slough thistle. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of slough thistle for a total of two occurrences within the 10,000 acres of restored floodplain on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis (Objective ST1.1: associated with CM3 and CM11).

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 1A would adversely affect 982 acres, including 15 acres that are modeled habitat for Delta button-celery and 11 acres that are modeled habitat for slough thistle. Table 12-1A-65 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status grassland plant in the study area.

Table 12-1A-65. Summary of Impacts on Valley/Foothill Riparian Plants under Alternative 1A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button-celery modeled habitat	3,361[a]	15	0	0	Habitat loss from floodplain restoration
Slough thistle modeled habitat	1,834	11	0	0	Habitat loss from floodplain restoration
Valley/foothill riparian habitat	17,966	892	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta button-celery	0	0	1[b]	1	Occurrence potentially affected by floodplain restoration
Slough thistle	0	0	2	2	Occurrences potentially affected by floodplain restoration
Noncovered Species					
Northern California black walnut	0	0	1	0	None
Wright's trichocoronis	0	0	1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland.
[b] A second occurrence is in alkali seasonal wetland.

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plants are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would be affected by restoration of seasonally inundated floodplain.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Construction of the water conveyance facilities would remove 86 acres of valley-foothill riparian habitat under Alternative 1A. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the proposed footprint for the Alternative 1A water conveyance facilities. Therefore, under Alternative 1A, construction and operation of the water conveyance facilities would not affect covered or noncovered special-status valley/foothill riparian plants.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction and operation of the Yolo Bypass fisheries enhancements would adversely affect 176 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass fisheries enhancements would not affect the covered or noncovered valley/foothill riparian plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to protect 552 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 552 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for tidal restoration. Therefore, tidal restoration would not affect the covered or noncovered valley/foothill riparian plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove about 78 acres of valley/foothill riparian habitat, including 15 acres of modeled habitat for Delta button-celery along the San Joaquin River in CZ 7. In addition, floodplain restoration would result in more frequent and longer inundation of 18 acres of modeled habitat for Delta button-celery in this area. The area affected contains one historic occurrence of Delta button celery. This occurrence is considered to be extirpated, because all habitat for Delta button-celery at his location has been converted to agriculture (California Department of Fish and Wildlife 2013). Therefore, Alternative 1A would not have an adverse effect on Delta button celery in CZ 7.

  The BDCP proposes to benefit Delta button-celery at this location by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of Delta button-celery. Although Delta button celery occurs in riparian habitat, it is not associated with woodland or scrub habitats; rather, it occurs in alkali seasonal wetlands in floodplains, which may or may not also contain adjacent woody riparian habitat. Restoring habitat for Delta button-celery may not be compatible with restoring woody riparian habitat. In addition, establishing new populations of Delta button-celery is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on Delta button-celery would be speculative.

  Floodplain restoration levee construction would remove 11 acres of modeled habitat for slough thistle and would result in more frequent and longer inundation of 6 acres of modeled habitat for slough thistle along the San Joaquin River in CZ 7. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to riparian habitat. Whether the affected modeled habitat is actually occupied by slough thistle is not known; however, of two historic occurrences of slough thistle present in the study area, only one is considered to be extirpated (California Department of Fish and Wildlife 2013). The BDCP would protect and enhance two occurrences of slough thistle. If occurrences are not found in the study area, then two self-sustaining occurrences of slough thistle would be established using locally-sourced genetic material for a total of two occurrences within the restored floodplain habitat on the main stem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. Establishing new populations of slough thistle is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on slough thistle would be speculative.

One historic occurrence of Wright's trichocoronis in the study area near Lathrop (CZ 7) could also be affected by floodplain restoration. The occurrence is presumed to be extant because the presence or absence of suitable habitat has not been verified by field surveys (California Department of Fish and Wildlife 2013). However, the species has not been observed at this location for nearly a century, and habitat for Wright's trichocoronis, which would have been similar to that for Delta button celery and slough thistle, no longer appears to be present in aerial photographs of the area. Therefore, Alternative 1A would not be expected to have an adverse effect on Wright's trichocoronis.

- *CM6 Channel Margin Habitat Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM8 Grassland Natural Community Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on covered and noncovered valley/foothill riparian plants.
- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of CM5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 1A is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for covered plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 1A would not have an adverse effect on these species.

The BDCP proposes to benefit Delta button-celery and slough thistle by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of both species. Establishing new populations of Delta-button-celery or slough thistle would be a beneficial effect. However, establishing new populations is an untried, unproven procedure and may not be feasible.

NEPA Effects: Implementation of the BDCP under Alternative 1A would not have an adverse effect on special-status valley/foothill riparian plant species.

CEQA Conclusion: Alternative 1A would not result in a reduction in the range and numbers of covered and noncovered valley/foothill riparian plants. This impact would be less than significant. No mitigation is required.

Tidal Wetland Plants

Seven covered plants and one noncovered special-status plant occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1A-66). Five tidal wetland habitat models were developed for the seven covered plant species occurring in tidal wetland habitat.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP geographic information system (GIS) vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP valley/foothill riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all tidal brackish emergent wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitats cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 1A would include the following conservation actions over the term of the BDCP to benefit covered tidal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites, or within the area of affected tidal range of restoration projects (Objective DMW/ML1.1, associated with CM4 and CM11),
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Objective DTP/SMA1.1, associated with CM4 and CM11).
- Restore tidal inundation to wetlands in the Hill Slough Ecological Reserve and to the ponded area at Rush Ranch (Objective SBB/SuT1.1, associated with CM4).
- Complete seed banking of all existing Suisun Marsh populations and the representative genetic diversity using accepted seed banking protocols (Objective SBB/SuT1.2, associated with CM11).
- Establish a cultivated population of Suisun thistle from wild seed using accepted seed collection protocols (Objective SBB/SuT1.3, associated with CM11).
- Establish two occurrences of Suisun thistle in Conservation Zone 11 (Objective SBB/SuT1.4, associated with CM11).

Of 17,357 acres of tidal wetlands in the study area, Alternative 1A would affect 21 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, Suisun Marsh aster, soft bird's-beak, and Suisun thistle. Known occurrences of all of these species would be affected. In addition, four occurrences of Bolander's water-hemlock, a noncovered special-status plant, could be affected by tidal habitat restoration. Table 12-1A-66 summarizes the acreage of modeled habitat for covered tidal wetland species and the number of occurrences of each special-status tidal wetland plants in the study area.

1 **Table 12-1A-66. Summary of Impacts on Tidal Wetland Plants under Alternative 1A**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/Mason's lilaeopsis modeled habitat	6,081	48	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Side-flowering skullcap modeled habitat	2,497	10	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Soft bird's-beak modeled habitat	1,228	73	0	0	Habitat loss from tidal habitat restoration
Delta tule pea/ Suisun Marsh aster modeled habitat	5,853	3	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Suisun thistle modeled habitat	1,281	73	0	0	Habitat loss from tidal habitat restoration
Tidal brackish emergent wetland	8,501	0	0	0	Habitat loss from tidal habitat restoration
Tidal freshwater emergent wetland	8,856	21	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta mudwort	0	0	58	3	Occurrences affected by tidal habitat restoration
Delta tule pea	0	0	106	26	Occurrences affected by tidal habitat restoration
Mason's lilaeopsis	0	0	181	23	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Side-flowering skullcap	0	0	12	0	None
Soft bird's-beak	0	0	13	7	Occurrences affected by tidal habitat restoration
Suisun Marsh aster	0	0	164	26	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Suisun thistle	0	0	4	0	None
Noncovered Species					
Bolander's water hemlock	0	0	8	3	Occurrences affected by tidal habitat restoration

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 1A would have adverse effects on tidal marsh special-status plants through implementation of CM1, CM2, CM4, and CM5. No adverse effects are expected from implementation of CM3, CM6, CM7, CM8, and CM9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Construction of the Alternative 1A water conveyance facilities would remove 34 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 4 acres of modeled habitat for side-flowering skullcap, and 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, 8 occurrences of Mason's lilaeopsis, one occurrence of Suisun Marsh aster, and one occurrence of side-flowering skullcap in the study area could be affected by construction impacts. No known occurrences of the other covered and noncovered tidal wetland species would be affected by construction of the water conveyance facilities.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 5 acres of modeled habitat for Mason's lilaeopsis and delta mudwort. The extent to which modeled habitat is actually occupied by these species is not known; however, no known occurrences in the study area would be affected. Yolo Bypass operations would result in more frequent and longer inundation of 8 acres of modeled habitat Delta tule peas and Suisun Marsh aster. Two occurrences of Suisun Marsh aster would be affected by Yolo Bypass operations. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes restoring or creating 20 linear miles of transitional tidal areas within other natural communities that would be created or restored, including 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland. In addition, the habitat and ecosystem functions of these areas would be maintained and enhanced. The BDCP does not specifically propose to protect any occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences. Instead, the BDCP assumes that the 20 linear miles of restored transitional tidal areas would be passively colonized by the covered tidal wetland plants.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 6 acres of modeled habitat for Mason's lilaeopsis and Delta mudwort. Habitat loss would occur through conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 14 of 181 known occurrences of Mason's lilaeopsis and 3 of 58 known occurrences of delta mudwort in the study area could be affected by tidal habitat restoration.

  Tidal habitat restoration would remove 4 acres of modeled habitat for side-flowering skullcap. Whether the affected modeled habitat is actually occupied by side-flowering skullcap is not known; however, none of the 12 known occurrences in the study area would be affected.

  Tidal habitat restoration would remove 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. However, the BDCP would allow up to 50 acres of modeled habitat to be removed.

Habitat loss would result from conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 26 of 106 known occurrences of Delta tule pea and 24 of 164 occurrences of Suisun Marsh aster in the study area would be affected.

Tidal habitat restoration could affect 73 acres of modeled habitat for soft bird's-beak and Suisun thistle, including 1.3 acres of critical habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, seven of 13 known occurrences of soft bird's-beak in the study area could be affected. None of the four known occurrences of Suisun thistle in the study area would be affected.

Tidal habitat restoration could affect three of eight known occurrences of Bolander's water-hemlock, a noncovered special-status species in the study area. Because Bolander's water-hemlock occurs in tidal marsh, it may benefit from tidal marsh restoration. However, site preparation, earthwork, and other site activities could adversely affect Bolander's water-hemlock through direct habitat removal.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 3 acres of modeled habitat for Mason's lilaeopsis and delta mudwort and 2 acres of modeled habitat for side-flowering skullcap. No known occurrences of these species in the study area would be affected by floodplain restoration.

  Floodplain restoration would result in more frequent and longer inundation of 2 acres of modeled habitat for Mason's lilaeopsis and delta mudwort, 18 acres of modeled habitat for side-flowering skullcap, and 1 acre of modeled habitat for Delta tule peas and Suisun Marsh aster. No known occurrences of these species in the study area would be affected by periodic inundation of restored floodplain habitat. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed separately from the effects of tidal habitat restoration. Channel margin enhancement would have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would have beneficial effects on these species by improving the habitat functions for these species as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.

- *CM7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of CM4 and CM5. Riparian plantings carried out for CM7 would be placed in floodplain areas, not in tidal wetlands.

- *CM8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on covered and noncovered tidal wetland plants.
- *Avoidance and Minimization Measures*: Effects on covered tidal wetland plants potentially resulting from implementation of CM1, CM2, CM4, and CM5 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 contains specific guidance to avoid adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis and woolly rose-mallow. AMM37 requires that new recreation trails avoid populations of covered tidal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, the GIS analysis indicates that Alternative 1A would result in the loss of modeled habitat for all of the covered species and result in adverse effects on known occurrences of most of the special-status plants occurring in tidal wetlands. However, the BDCP predicts that habitat restoration activities would greatly expand the amount of habitat available to each of these species, offsetting any potential loss of habitat or occurrences resulting from covered activities.

Delta mudwort could lose 48 acres of modeled habitat (0.8%), including all or part of three occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta mudwort, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Mason's lilaeopsis could lose 48 acres of modeled habitat (0.8%), including all or part of 23 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Mason's lilaeopsis; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Delta tule pea could lose 3 acres of modeled habitat (0.05%), including all or part of 26 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta tule pea, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta tule pea; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11–22, associated with CM11).

Suisun Marsh aster could lose 3 acres of modeled habitat (0.05%), including all or part of 26 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun Marsh aster, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Suisun marsh aster; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would occur and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

All four of these species (Delta mudwort, Mason's lilaeopsis, Delta tule pea, and Suisun Marsh aster) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring large areas of habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected (less than 1% of the total), it is likely that the initial adverse effects of covered activities on these species would be offset and that the overall effect of Alternative 1A on these species would not be adverse.

Side-flowering skullcap could lose 10 acres of modeled habitat (0.4%), but no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by side-flowering skullcap, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for side-flowering skullcap; creation of suitable habitat under these measures could also help offset this habitat loss. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because loss of modeled habitat for the species would be offset through restoration, the overall effect of Alternative 1A on this species would not be adverse.

Soft bird's-beak could lose 73 acres of modeled habitat (6%), including all or part of seven occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by soft bird's-beak, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve would be done to increase potential habitat there for soft bird's-beak (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for soft bird's-beak. Although no active restoration of this species is proposed, post-implementation monitoring of soft bird's-beak occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Soft bird's-beak has a restricted distribution in the study area with highly localized occurrences, and habitat modification is the primary factor responsible for the species' decline and limiting the species' distribution and abundance. Improving habitat functions for this species would provide a reasonable expectation that the distribution and abundance of soft bird's-beak would also improve. Although a substantial amount of modeled habitat could be affected, the primary habitat for soft bird's-beak is high tidal brackish marsh, and the affected habitat is low tidal brackish marsh. Therefore, it is likely that the overall effect of Alternative 1A on this species would not be adverse.

Suisun thistle could lose 73 acres of modeled habitat (6%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun thistle, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve and at Rush Ranch would be done to increase potential habitat there for Suisun thistle (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for Suisun thistle. In addition, two new occurrences of Suisun thistle would be established in CZ 11 (Objective SBB/SuT1.4, associated with CM11). Post-implementation monitoring of Suisun thistle occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Habitat restoration, enhancement of habitat functions, and establishment of new occurrences would offset any potential loss of modeled habitat for Suisun Marsh thistle.

Three occurrences of Bolander's water-hemlock could be affected. Although the extent of potential habitat affected was not determined, it would be comparable to that for Delta tule pea and Suisun Marsh aster (5 acres). Tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) could increase the extent of habitat available for colonization by Bolander's water-hemlock, which could offset this habitat loss. Because only a few scattered occurrences of Bolander's water-hemlock are present in the study area, there is no reasonable expectation that habitat restoration without active species-specific restoration activities would result in the establishment of new occurrences to offset the losses. Also, because Bolander's water-hemlock is a noncovered species, the species protections and occurrence monitoring afforded to covered species under the BDCP would not apply to this species. Therefore, the effects of Alternative 1A on Bolander's water hemlock could be adverse.

NEPA Effects: The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (CM4). Therefore, implementation of Alternative 1A would result in no adverse effects on seven of eight special-status grassland plants in the study area. Alternative 1A would result in a reduction in the range and numbers of Bolander's water-hemlock, which would be an adverse effect. Adverse effects on Bolander's water-hemlock could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of occurrences and modeled habitat for covered tidal habitat plant species would be offset through habitat restoration, impacts on covered tidal wetland plants as a result of implementing Alternative 1A would not be significant. However, the loss of Bolander's water-hemlock populations in CZ 11 would result in a reduction in the range and numbers of this species and would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

Inland Dune Plants

Five special-status plants occur in inland dune habitat in the study area. None of the species is covered under the BDCP, and no habitat models were prepared for inland dune habitat. Table 12-1A-67 summarizes the acreage of inland dune habitat in the study area and the number of occurrences of each special-status inland dune plant in the study area.

Table 12-1A-67. Summary of Impacts on Inland Dune Plants under Alternative 1A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Inland Dunes	19	0	0	0	None
Noncovered Species					
Hoover's cryptantha	0	0	1	0	None
Antioch Dunes buckwheat	0	0	1	0	None
Mt. Diablo buckwheat	0	0	1	0	None
Contra Costa wallflower	0	0	3	0	None
Antioch Dunes evening-primrose	0	0	9	0	None

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 1A, would have no adverse effects on inland dune plants (Table 12-1A-67). No construction activities or habitat restoration would take place where the species occur. No specific actions to benefit inland dune species are proposed.

NEPA Effects: Implementing the BDCP under Alternative 1A would not affect special-status inland dune plant species.

CEQA Conclusion: Because the BDCP would not affect inland dune habitat, implementation of Alternative 1A would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Plants

No covered plant species occur in nontidal wetlands in the study area; however, six noncovered special-status plant species occur in nontidal wetlands in the study area. Table 12-1A-68 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland plant in the study area.

Table 12-1A-68. Summary of Impacts on Nontidal Wetland Plants under Alternative 1A

	Acres in Study Area	Acres affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal perennial aquatic	5,567	290	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Nontidal freshwater perennial emergent wetland	1,509	128	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass Fisheries enhancements, and floodplain restoration
Noncovered Species					
Watershield	0	0	3	1	Loss of habitat from construction of water conveyance facilities
Bristly sedge	0	0	18	2	Loss of habitat from construction of water conveyance facilities
Woolly rose-mallow[a]	0	0	121	13	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Eel grass pondweed	0	0	1	0	None
Sanford's arrowhead	0	0	23	2	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Marsh skullcap[a]	0	0	5	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 1A, known occurrences watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead are within the proposed footprint for the water conveyance facilities or within the hypothetical footprint for restoration activities and would be adversely affected. Alternative 1A would have no adverse effects on eel-grass pondweed or marsh skullcap.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Construction of the Alternative 1A water conveyance facilities would adversely affect four noncovered special-status plants occurring in nontidal wetlands. One of three watershield occurrences in CZ 5 on Bouldin Island could be affected by construction of the water conveyance facilities. This is a historical occurrence that has not been observed since 1893, and it may be extirpated (California Department of Fish and Wildlife 2013). Two occurrences of bristly sedge in CZ 4 and CZ 5, including approximately 1.54 acres of occupied habitat, would be affected by construction of the water conveyance facilities. Twelve occurrences of woolly rose-mallow would be affected. Three occurrences in CZ 3 would be removed during construction of the intake facilities, and five occurrences in CZ 6 and one occurrence in CZ 8 would be affected by construction of other facilities. Construction of the water conveyance facilities would remove occupied habitat at one occurrence of Sanford's arrowhead in CZ 5.
- *CM2 Yolo Bypass Fisheries Enhancement*: No known occurrences of special-status nontidal wetland plants are present in the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass fisheries enhancements would not affect special-status nontidal marsh plants.
- *CM3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under the BDCP. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *CM4 Tidal Natural Communities Restoration*: One known occurrence of Sanford's arrowhead and one occurrence of woolly rose mallow in CZ 7 are present within areas that could be affected by tidal habitat restoration. Therefore, tidal habitat restoration could have an adverse effect on these two species. No other known occurrences of special-status nontidal wetland plants are present within areas proposed for tidal habitat restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on special-status nontidal wetland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status nontidal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status nontidal wetland plants.
- *CM8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status nontidal wetland plants.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. The BDCP may benefit nontidal wetland species by creating 400 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for covered and other native species. However, no specific actions to benefit noncovered species are proposed.

Under Alternative 1A, 1,500 acres of nontidal marsh would be restored (Objective NFEW/NPANC1.1, addressed under CM10). However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, potential loss of habitat or occurrences resulting from covered activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under the BDCP, the species protections afforded to covered species under the AMMs do not apply to these species, and the effects of Alternative 1A on these species would be adverse.

NEPA Effects: Implementation of the BDCP under Alternative 1A could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, four noncovered nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Under Alternative 1A, construction of the water conveyance facilities could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead. Tidal habitat restoration could result in a reduction in the range and numbers of Sanford's arrowhead. These impacts would be significant. Implementation of Mitigation Measure BIO-170 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

General Terrestrial Biology Effects

Wetlands and Other Waters of the United States

Alternative 1A actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The Section 404 regulations and relevant information regarding mitigation of impacts on wetlands and waters of the United States are described in Section 12.2.1.1. The following two impacts address the project-level effects of CM1 on these potential wetlands and waters, and the programmatic-level effects of other relevant conservation actions (CM2–CM10). CM11–CM21 would not directly result in loss or conversion of wetlands or other waters of the United States. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. The waters of the United States data used for this analysis is based on a verified wetland delineation from USACE that was completed in early 2015. These waters of the United States were mapped at finer scale than that which was done for the natural community mapping for the BDCP; therefore, the acreages of these two datasets differ. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States

Alternative 1A proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-1A-69. Based on the methodology used to conduct this analysis, the losses would occur at intake, tunnel, pipeline, canal, and RTM and borrow/spoil storage sites, transmission corridors, and multiple temporary work areas associated with the construction activity. The permanent open water and wetland losses would occur at various locations along the pipeline/tunnel alignment, but the majority would occur due to construction of Alternative 1A's five intake structures along the eastern bank of the Sacramento River between Freeport and Courtland in the north Delta (including associated spoil/borrow areas), construction of forebays in both the north and south Delta areas, and the RTM storage sites associated with tunnel construction at various locations, including on Andrus, Tyler, Venice and Bacon Islands. However, through implementation of an environmental commitment to reuse RTM or dispose of it at appropriate facilities, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, it is anticipated that the material would be removed from these areas and applied, as appropriate, as bulking material for levee maintenance or as fill material for habitat restoration projects, or would be put to other beneficial means of reuse identified for the material. The temporary open water and wetland effects would also occur mainly at the five intake construction sites along the eastern bank of the Sacramento River, and at barge unloading facilities in the San Joaquin and Middle Rivers.

Table 12-1A-69. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 1A (acres)

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact	Total Impact
Agricultural Ditch	64.9	23.4	0	88.4
Alkaline Wetland	0.10	0	0	0.1
Clifton Court Forebay	1.0	0	0	1.0
Conveyance Channel	12.7	1.1	0	13.8
Depression	1.9	1.8	0	3.7
Emergent Wetland	46.8	7.3	0	54.0
Forest	5.8	11.9	0	17.7
Lake	0	0.3	0	0.3
Scrub-Shrub	20.6	4.3	0	24.9
Seasonal Wetland	18.7	26.6	0	45.4
Tidal Channel	42.9	133.8	0	176.7
Vernal Pool	0	0	0	0
Total	**215**	**211**	**0**	**426**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

The majority of the impacts on wetlands and waters of United States are on tidal channels, emergent wetlands, and wetlands and waters found within cultivated lands (agricultural ditches and seasonal wetlands). These impacts would mostly result from the construction of the barge unloading facilities, intake work areas, shaft locations, and transmission lines. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the CWA permitting process. The results of this assessment will be compared with the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands would be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Because many impacted wetlands are significantly less than high function, the compensatory mitigation would result in a net increase in wetland function.

Alternative 1A was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures would be implemented, as described in the AMMs set out in BDCP Appendix 3.C and Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the United States are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, would also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing CM4-CM10, some of which could serve the dual purpose of offsetting effects on species and mitigating impacts on waters of the United States, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 1A pursuant to USACE's and the Environmental Protection Agency's Mitigation Rule (see Section 12.2.1.1, *Sections 404 and 401 of the Clean Water Act*). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.* would be available to address adverse impacts on waters of the United States.

NEPA Effects: The permanent and temporary loss of these jurisdictional wetlands and waters as a result of constructing Alternative 1A water conveyance facilities would be a substantial effect if not compensated by wetland protection and/or restoration. This loss would represent a removal of federally protected wetlands as defined by Section 404 of the CWA. Impacts on wetlands from CM1 construction would occur in the first 10 years after BDCP approval. Project proponents under

Alternative 1A would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. However, specific mitigation would be required to ensure that Alternative 1A does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

***CEQA Conclusion*:** The permanent and temporary loss of these jurisdictional wetlands and waters of the United States as a result of constructing Alternative 1A water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 1A does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level. Alternative 1A does propose to restore up to 76,721 acres of wetland natural communities under the Plan, which would include 65,000 acres of tidal marsh restoration (CM4), 10,000 acres of seasonally inundated floodplain restoration (CM5), 21 acres of vernal pool/alkali seasonal wetlands (CM9; 67 acres of vernal pool complex and 72 acres of alkali seasonal wetland complex assuming a wetland density of 15%), and 1,700 acres of nontidal marsh restoration (CM10). In addition, Alternative 1A would restore 5,000 acres of riparian habitat (CM7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 20 miles of levees will have channel margin enhancement conducted on them (CM6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees.

The success in implementing these Conservation Measures would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP for tidal marsh restoration (BDCP Chpater 3, Section 3.4.4.4), seasonal floodplain restoration (BDCP Section 3.4.5.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 1A would also result in the protection and management of the following natural communities that contain wetlands: 750 acres of valley/foothill riparian, 600 acres of vernal pool complex, 150 acres of alkali seasonal wetland complex, 8,100 acres of managed wetlands, and 50 acres of nontidal marsh. In addition, 8,000 acres of grasslands and 51,625 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Project proponents under Alternative 1A would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of waters of the United States and any indirect effects on wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 1A does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 1A's other conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and waters of the United States in the study area over the course of BDCP conservation action implementation. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures (CM2, CM4, and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in BDCP Chapter 5, *Effects Analysis*.

Because the wetland delineation was only conducted within the Conveyance Planning Area and not the remainder of the Plan Area, the effects on potential wetlands and waters of the United States from CM2-CM10 were analyzed by looking at effects on wetland natural communities mapped within the theoretical footprints for CM2, CM4, and CM5 by assuming that 100% of the predominantly wetland natural communities listed in Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, and that 10% of all of the non-wetland natural communities listed in that table would qualify as wetlands or other waters of the United States under the CWA. Based on this approach approximately 19,850 acres of potentially jurisdictional wetlands and waters could be affected by CM2-CM10. The majority of these impacts are attributable to the conversion of 13,746 acres of managed wetland to tidal marsh under CM4, which would likely result in an improvement of wetland function in the Plan Area.

NEPA Effects: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1A would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. Although the increase in wetland acreage and wetland functions from these restoration actions could in part offset the effects on waters of the United

States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

***CEQA Conclusion*:** The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1A would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. In total, up to 76,721 acres of wetland natural communities would be restored under Alternative 1A. Although the increase in wetland acreage and wetland functions from this restoration could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds. The primary effects of concern for shorebirds and waterfowl are related to the conversion of managed wetland and cultivated lands to tidal marsh associated with habitat restoration. Ducks Unlimited (2013) conducted an analysis to determine the effects of BDCP conservation measures on waterfowl, as well as to determine whether BDCP actions would impede attainment of the goals established by the Central Valley Joint Venture (CVJV) Implementation Plan for the Delta, Yolo, and Suisun Marsh drainage basins. The CVJV efforts are guided by its 2006 Implementation Plan, which is founded on the principles of strategic habitat conservation (Central Valley Joint Venture 2006). Those principles emphasize the establishment of population abundance objectives and the use of species-habitat models to link population objectives to habitat needs. The CVJV has used species-habitat models to translate bird abundance objectives into habitat objectives, while explicitly identifying the biological assumptions that underpin these models and the data used to populate them. As a result, the CVJV's biological planning provides a framework for evaluating the effects of the BDCP on waterfowl.

The Ducks Unlimited waterfowl analysis focused primarily on dabbling ducks. Less than 5% of all geese in the Central Valley occur in the Yolo, Delta, and Suisun Marsh drainage basins. Moreover, geese in the Central Valley rely mostly on agricultural habitats to meet their food energy needs. The BDCP's effect on agricultural habitats is limited to the Delta Basin where about 2500 acres of corn now available to geese would be converted to other habitats (Ducks Unlimited 2013: Table 5). Food supplies for geese would still be well in excess of demand even with the loss of these agricultural habitats (Central Valley Joint Venture 2006, Ducks Unlimited 2013). The duck population objectives used in the analysis were taken directly from the CVJV Plan. Dabbling duck species make up 92% of this objective, while diving duck species make up the remaining 8%. Thus, the results were mostly driven by dabbling duck needs and largely interpreted in the context of dabbling duck foraging ecology. The 55,000 acres of Tidal Natural Communities Restoration (CM4) would be expected to benefit diving ducks by providing deep water foraging habitat. Refer to the Ducks Unlimited Report (Ducks Unlimited 2013) for details of the analysis and methods with respect to the TRUMET model used to quantify effects on food biomass and food quality.

An analysis was conducted to determine the effects of the BDCP covered activities on wintering and breeding shorebird habitat (ICF International 2013). This analysis evaluated the relative increase and decrease in natural communities known to provide important foraging, roosting, and breeding habitat. Similar to the waterfowl analysis, the results were broken up into the three Central Valley Joint Venture Basins that overlap with the BDCP Plan Area: Yolo, Delta, and Suisun. Natural community losses and gains were then translated into species-specific outcomes, comparing the relative habitat value of each BDCP natural community for each Central Valley shorebird species (Table 1, ICF International 2013). The shorebird species ranking system displayed in Table 1 (ICF International 2013) was modified from a table in Stralberg et. al (2010). The table was created using survey data and experts' species-specific habitat rankings. The survey data included fall, winter, and spring density data. This resulted in an overall, cross-season representation of habitat requirements.

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities (CM1) would result in the permanent removal of approximately 3 acres of managed wetland, 6 acres of tidal wetlands, 13 acres of nontidal wetlands, and 2,541 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 83 acres of managed wetland, 6 acres of tidal wetlands, 10 acres of nontidal wetlands, and 899 acres of cultivated lands would be temporarily impacted.

These losses of habitat would occur within the first 10 years of Alternative 1A implementation in the Delta Basin. The BDCP has committed to the near-term protection of 15,400 acres of non-rice cultivated lands, 200 acres of rice, and 700 acres of rice or "rice equivalent" natural communities including nontidal wetlands in the near-term. In addition, 4,100 acres of managed wetlands would be created, protected, and enhanced, 8,850 acres of freshwater tidal wetlands would be restored, and 2,000 acres of tidal brackish emergent wetland would be restored (Table 3-4, Chapter 3).

Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

NEPA Effects: Habitat loss from construction of the Alternative 1A water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse effect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

CEQA Conclusion: Habitat loss from construction of the Alternative 1A water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Conservation Components

Suisun Marsh: Managed seasonal wetlands in Suisun Marsh would be reduced by an estimated 8,818 acres as a result of Alternative 1A implementation. This would represent a 25% decrease in managed seasonal wetlands compared with long-term conditions without Alternative 1A (Ducks Unlimited 2013, Table 5). There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the amount of mitigation needed. To address this uncertainty, three levels of food biomass and three levels of nutritional quality were modeled for these existing habitats (Ducks Unlimited 2013, Table 7). Three mitigation scenarios based on these energetic assumptions of biomass and food quality were then run to determine a minimum acreage of managed seasonal wetlands to be protected and enhanced to compensate for the loss of productivity resulting from habitat conversion to tidal wetlands.

- Scenario 1) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 50% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 60% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 5,000 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 2) Assume that the managed seasonal wetlands lost provide medium food biomass and medium food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun Marsh could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 13,300 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 3) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Given the assumption that managed seasonal wetlands in Suisun Marsh could only be enhanced to provide medium food biomass and medium food quality (produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, with these seeds having 80% of the metabolizable energy of seeds produced outside of Suisun Marsh), 8,800 acres of managed wetlands protected and managed for medium biomass and medium food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

The BDCP has committed to protecting and enhancing a minimum of 5,000 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity from habitat conversion to tidal marsh. This minimum commitment of 5,000 acres would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this effect.

Yolo and Delta Basins: The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to have an adverse effect on food productivity, under the assumption that these wetlands would provide adequate food sources. However, a monitoring component and a food study in these tidal habitats would be necessary in order to demonstrate that there would be a less than significant loss of food value in these habitats for wintering waterfowl. If it is determined from monitoring that there in fact would be a significant loss in food productivity resulting from habitat conversion to tidal wetlands, the protection and enhancement of managed wetlands in these watersheds would require mitigation for the change in food biomass and quality. Mitigation Measure *BIO-179b, Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty.

***NEPA Effects*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of effect that Alternative 1A habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1A to avoid an adverse effect on wintering waterfowl in the Suisun Marsh. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these new wetlands would provide adequate food sources is entirely dependent on assumptions about food production in palustrine tidal habitats. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty and avoid an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of impact that Alternative 1A habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food for wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1A to avoid having a significant impact on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Implementation of Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would address this potential significant impact.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity. However, the conclusion that these tidal wetlands would provide adequate food sources for wintering waterfowl is entirely dependent on assumptions about food production in palustrine tidal habitats. Studies of food biomass and food quality in palustrine tidal habitats are needed to confirm that no mitigation for wintering waterfowl would be required in the Yolo and Delta Basins. Implementation of Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would address this uncertainty and would reduce this impact on wintering waterfowl to a less-than-significant level.

Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh

Poorly managed wetlands (considered low biomass and food quality) will be identified and managed by BDCP proponents to improve food quality and biomass. Studies will be required to quantify 1) food production of existing managed wetlands in Suisun Marsh and 2) energetic productivity of brackish and tidal marsh habitats. Protected wetlands will be monitored to measure changes in the energetic productivity of these sites. Based on the food studies and monitoring results, BDCP proponents will determine if the minimum commitment of 5,000 acres is sufficient to meet the goal of 1:1 compensation for loss of wintering waterfowl habitat with the protection and management of managed wetlands in perpetuity. If monitoring demonstrates that additional acreage is needed to meet this goal, additional acreage of protection or creation of managed wetlands and management will be required.

Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins

In order to address the uncertainty of the impact of loss of managed wetlands in the Yolo and Delta Basins on wintering waterfowl, BDCP proponents will conduct food studies and monitoring to demonstrate the food quality of palustrine tidal habitats in these basins. If studies show that the assumption of no effect was inaccurate, and the food quality goal of 1:1 compensation for wintering waterfowl food value is not met, additional acreage of protection or creation of managed wetland and management will be required.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Conservation Components

Implementation of Alternative 1A would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1A would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. While a reduction in these semipermanent habitats would represent a habitat loss for breeding waterfowl, with the restoration of 24,000 acres of palustrine tidal wetlands (Table 3-4, Chapter 3) in the Yolo and Delta basins there would be a less than adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (i.e., March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1A.

Suisun Marsh: Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres from the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared to seasonally managed habitats (Central Valley Joint Venture 2006).

The BDCP includes a commitment to protect and enhance 1,600 acres of permanently flooded managed wetlands in Suisun Marsh to provide habitat for breeding waterfowl. In addition, 5,000 acres of semipermanent wetlands that would be protected and enhanced for wintering and migratory waterfowl (Table 3-4, Chapter 3; Objective MWNC1.1, BDCP Chapter 3, *Conservation Strategy*).

Food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. These studies would be needed in order to quantify impacts on breeding waterfowl in Suisun Marsh and to determine not only the number of acres that would compensate for loss of breeding habitat at a ratio of 1:1 for habitat value, but how those acres should be managed. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of this effect.

In addition to providing semipermanent wetlands to breeding waterfowl, the Suisun Marsh contains several key upland areas that have significant nesting value. The largest block of upland habitat in the region is the core area on the Grizzly Island Wildlife Area. This area does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this core area includes over 2,000 acres of upland grasslands that have some of the highest duck nesting densities in California (Central Valley Joint Venture 2006). A few small wetland areas are scattered within this core grassland mosaic that provide necessary freshwater brooding habitat. If restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding waterfowl would likely be greatly increased.

NEPA Effects: Alternative 1A would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1A would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1A would not have an adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1A implementation. Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but such management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss of breeding waterfowl habitat resulting from implementation of Alternative 1A could have an adverse effect. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of model assumptions and the potential adverse effect of habitat conversion on breeding waterfowl in Suisun Marsh.

CEQA Conclusion: Alternative 1A would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1A would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203, acres respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1A would have a less-than-significant impact on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1A.

Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss or conversion of habitat from implementation of Alternative 1A could have a significant impact on breeding waterfowl in Suisun Marsh. Implementation of Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would address the uncertainty of model assumptions and reduce the impact to a less-than-significant level.

Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

To address the uncertainty of the impact of loss of managed wetlands in Suisun Marsh on breeding waterfowl, BDCP proponents will conduct food studies and monitoring to determine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the marsh.

The required studies will examine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the Marsh. Reproductive studies will address but will not be limited to the following questions:

- How does the distribution of breeding waterfowl in Suisun Marsh differ in tidal versus managed habitats and across salinity gradients?
- How does waterfowl nest success and nest density vary with respect to tidal versus managed habitats and across salinity gradients?
- What are the patterns of habitat selection and movements by waterfowl broods in relation to tidal vs. managed habitats, and are there impacts on duckling survival?
- What is the current relationship between waterfowl reproductive success and interactions with alternate prey and predators, and how is tidal restoration likely to alter these relationships?

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20 cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

Yolo Basin: Primarily as a result of *CM4 Tidal Natural Communities Restoration* within the Yolo Basin, 1,185 acres of managed wetland habitat would be permanently converted; 1,066 acres of which are protected. In addition, 42 acres of managed wetland habitat would be temporarily lost by construction-related activities associated with tidal restoration (CM4) and Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could periodically affect managed wetlands ranging from an estimated 643 acres during a notch flow of 1,000 cfs to an estimated 2,055 acres during a notch flow of 4,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*) in the Yolo Basin.

Delta Basin: Within the Delta Basin, 90 acres of managed wetland habitat would be permanently converted, as a result of tidal restoration (CM4). Thirteen of the 90 acres are protected (Table 3, ICF International 2013). Periodic flooding would not affect this natural community type in Delta Basin.

Suisun Basin: Within the Suisun Basin, 11,532 acres of managed wetland habitat would be permanently converted as a result of tidal restoration (CM4); 10,354 of which are protected. (Table 4). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (*Charadrius semipalmatus*), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

Managed wetlands would decrease in overall extent by 20% (Table 5, ICF International 2013). Most of this loss would occur in Suisun with some additional acreage loss in the Yolo Basin. The loss of managed wetland habitat for covered species and waterfowl would be compensated for with 8,200 acres remaining managed wetland protection in Suisun Marsh. Of these 8,200 acres, the 5,000 acres of seasonal wetland protected, enhanced, and managed to provide overwintering waterfowl foraging habitat would be the habitat type most likely to benefit overwintering shorebirds. However, the 1,600 acres of semi-permanent and permanent managed wetlands for breeding waterfowl and 1,500 acres of managed wetlands for salt marsh harvest mouse would also be expected to have some benefit to wintering and breeding shorebirds.

Cultivated Lands

Yolo Basin: Primarily as a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 8,309 acres of cultivated lands would be permanently converted; 1,272 acres of which are protected. Also within the Yolo Basin, increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could affect an estimated 3,219 acres of cultivated lands during a notch flow of 1,000 cfs to an estimated 5,512 acres during a notch flow of 6,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*).

Delta Basin: Within the Delta Basin, as a result of tidal restoration (CM4) and floodplain restoration (CM5), 25,633 acres of cultivated lands would be permanently converted. There would also be an additional 112 acres lost temporarily due to CM5 activities. Of the total permanently converted lands, 3,925 acres are protected (Table 3, ICF International 2013). Seasonal flooding (CM5) on the restored floodplain would periodically affect 738 acres of cultivated lands in Delta.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Cultivated land loss would occur in all three basins, but the majority of acreage loss would occur in the Delta basin. Pasture crop types would decrease in overall extent by 15% over baseline (Table 5, ICF International 2013), but would increase in protection by 135%. More than half of all cultivated lands within the 48,000-acre BDCP cultivated lands reserve would be in pasture production (primarily alfalfa) and enhanced and managed to benefit Swainson's hawk. Idle crop types are not identified as a specific conservation target in the BDCP, are expected to occur within the reserve and are recognized in the BDCP as having "moderate" foraging habitat value for Swainson's hawk, white-tailed kite, and greater sandhill crane.

Grain and hay crop would be expected to decrease by 13% (Table 5, ICF International 2013) while protection, enhancement and management would be expected to increase by 28% (Table 6, ICF International 2013). These crop types would be managed for a tricolored blackbirds, Swainson's hawk, white-tailed kite, greater sandhill crane, and burrowing owls.

Rice would decrease in overall extent by 2% (Table 5, ICF International 2013) but increase in total protection by 57%. Rice lands would be protected, enhanced, and managed for the benefit for giant garter snake.

Tidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 194 acres of tidal wetland habitat would be permanently converted; 180 acres of which are protected. In addition, 12 acres of tidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass would affect 3,957 acres of tidal wetlands in Yolo Basin.

Delta Basin: Within the Delta Basin, 54 acres of tidal wetlands would be permanently converted as a result of tidal restoration (CM4) (Table 3, ICF International 2013). Of the total permanently converted lands, 26 acres are protected. Periodic flooding in Yolo Bypass would affect 26 acres of tidal wetlands in Delta Basin.

Suisun Basin: Within the Suisun Basin, 219 acres of tidal wetland habitat would be permanently converted as a result of tidal restoration (CM4); 215 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

Tidal mudflat habitat would be estimated to increase in extent by 1,780 acres. This extremely large increase in tidal mudflat habitat would occur almost exclusively in Suisun Marsh as the result of tidal restoration and the conversion of existing mid- and high-marsh types to low marsh and tidal mudflats in response to sea level rise. BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, details the methods and assumptions modeled to come about this result. Tidal mudflat habitats would be expected to require management, however, sediment augmentation has been discussed as an experimental method that could be employed in places like Suisun to combat the loss of intertidal marshes in the face of sea level rise and reduced sediment supplies.

Tidal emergent wetland habitat would increase in extent by 152% (Table 5, ICF International 2013). Of the 30,000 acres of emergent wetland restoration, 6,000 acres would be in the Suisun Basin and the rest would be distributed between the Yolo and Delta Basins. Enhancement and management on these lands would be likely to be focused on nonnative, invasive species management. Any additional actions in Suisun would be focused on salt marsh harvest mouse, Suisun shrew, California clapper rail, black rail, Suisun thistle, and soft bird's-beak. In freshwater marshes, enhancement and management would be likely to focus on black rail, western pond turtle, and, in some cases, giant garter snake.

Nontidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 313 acres of nontidal wetland habitat would be permanently converted; 119 acres of which are protected. In addition, 11 acres of nontidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass associated with ongoing Fremont Weir operation (CM2) would affect 305 acres of nontidal wetlands in Yolo Basin, specifically nontidal perennial aquatic habitat.

Delta Basin: Within the Delta Basin, 99 acres of nontidal wetlands would be permanently converted as a result of tidal restoration (CM4) and floodplain restoration (CM5) (Table 3, ICF International 2013). There would also be 8 acres of nontidal perennial aquatic habitat temporarily lost from CM5 activities. Of the total permanently converted lands, 29 acres are protected. Periodic flooding from CM5 would affect 4 acres of nontidal perennial aquatic habitat in Delta Basin.

Suisun Basin: Within the Suisun Basin, 1 acre of nontidal wetland habitat, specifically vernal pool complex, would be permanently converted as a result of tidal restoration (CM4); and is not protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

Nontidal freshwater emergent wetland would increase in extent by 88% as a result of BDCP implementation (Table 5, ICF International 2013). These lands would be managed to benefit giant garter snake and located within the Delta Basin (likely in the vicinity of White Slough) and the Yolo Basin (in the Cache Slough area).

Impacts on wetted acres of vernal pool complex and alkali seasonal wetland complex would be avoided and thus loss of this community is not expected. However, up to 10 acres of wetted acre loss could be permitted under the Plan. Protection of vernal pool complex natural community would increase by 13% and by 6% for alkali seasonal wetlands (Table 6, ICF International 2013).

Protection of these two community types would enhance and manage habitat for vernal pool crustaceans and alkali-related plant species.

The protection and restoration of natural communities under the BDCP would also include management and enhancement actions under *CM11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under CM11, in areas where they would not conflict with covered species management.

- Managed Wetlands
  - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
  - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
  - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
  - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
  - Create low slopes on islands and levees; gradual angles (10-12:1) are better than steep angles.
  - Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
  - Potentially add material to levees or to islands to encourage nesting for some species.
- Cultivated Lands
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July–September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).

- Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).
- Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
- Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
- When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
- Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
- Maintain gently sloping levees and island sides (10-12:1; Iglecia et al. 2012).
- Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

NEPA Effects: Alternative 1A implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be substantial loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While substantial losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for the loss of substantial acreage, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

CEQA Conclusion: Alternative 1A implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be significant loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While significant losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for substantial acreage loss, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other conservation actions. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight-diverters on new transmission lines, and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect shorebirds and waterfowl, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. Measures described in BDCP Chapter 3, Section 3.4.13, *Conservation Measure 12 Methylmercury Management,* include provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on shorebirds and waterfowl.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of Alternative 1A water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 1A implementation would not have an adverse effect on shorebirds and waterfowl. Tidal habitat restoration is unlikely to have an adverse effect on shorebirds and waterfowl through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds, and the potential for increased exposure would vary substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management*, would address the uncertainty of methylmercury levels in restored tidal marsh. Once site-specific sampling and other information is developed, the site-specific planning phase of marsh restoration would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury.

CEQA Conclusion: Noise, potential hazardous spills, and increased dust and sedimentation as a result of Alternative 1A water conveyance facilities construction and operation and maintenance would have a significant impact on shorebirds and waterfowl. AMM1–AMM7 would minimize these impacts, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the impacts to a less-than-significant level. Tidal habitat restoration is unlikely to have a significant impact on shorebirds and waterfowl species through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds. Site-specific restoration plans that address the creation and mobilization of mercury, as well as the monitoring and adaptive management described in CM12, would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury in the study area. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1A implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not covered under laws or regulations that address conservation or protection of individual species. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2*, Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in in the analysis of Alternative 1A effects on natural communities (Impacts BIO-1 through BIO-31). In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the Plan over a 50-year time period, several natural communities and land cover types would be reduced in size, primarily from restoration of other natural communities. Grassland, managed wetland and cultivated lands would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement and management actions contained in the BDCP, including *CM3 Natural Communities Protection and Restoration*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3.C of the BDCP and updated in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing BDCP conservation measures would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife, including increased traffic on local roads from construction vehicles that could increase wildlife mortalilty and impede wildlife movement. Effects of construction traffic on wildlife moving in the vicinity of Stone Lakes National Wildlife Refuge would be minimized by AMM 20 *Greater Sandhill Crane*, which includes a measure for the installation of a vegetation screen or other noise and visual barrier along Hood Frankling Road for the benefit of cranes, which would be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and would provide a continuous surface impenetrable by light (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). This measure would potentially direct wildlife wishing to cross Hood Franklin toward the overcrossing of the canal that links the Stone Lakes properties (just east of the Town of Hood). The overcrossing includes strips of terrestrial habitat on either side of the canal.

Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants).

NEPA Effects: The direct and indirect effects of constructing water conveyance facilities and restoring tidal and other habitats associated with Alternative 1A would not be adverse to common wildlife and plants because conservation measures and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

CEQA Conclusion: Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of the BDCP is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

Essential Connectivity Areas (ECAs) are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effect of BDCP Conservation Measures on Wildlife Corridors

Alternative 1A water conveyance facilities would cross two of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA and the Mandeville Island-Staten Island ECA. The conveyance facilities would also cross one landscape linkage identified in the BDCP, the *Middle River* linkage (#6 in Figure 12-2). Though the conveyance facilities shown on Figure 12-2 overlap with the line representing the Sacramento River linkage (#9 in Figure 12-2) this line generally represents the course of the Sacramento River and is intended to address the needs of aquatic species and will thus not be addressed in this chapter.

The construction of Intakes 1, 2, 3, and 4, associated borrow and RTM areas, and forebay just east and south of Clarksburg, would be constructed within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the Sacramento River and the permanent and temporary loss of cultivated lands. Alternative 1A would not substantially increase impediments to the movement of any wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento River Deep Water Ship Channel already create a barrier to dispersal for nonavian species. However, the conversion of riparian and cultivated lands and the presence of the intakes and forebay would create a substantial barrier to the north-south movement of nonavian terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River. No records of wildlife species were identified within these construction footprints, though there are several records for Swainson's hawk in the vicinity. Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The addition of new permanent transmission lines within the Stone Lake-Yolo Bypass ECA could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes (see impact discussions for greater and lesser sandhill cranes). No records of wildlife species were identified within these construction footprints, though there are several records for Swainson's hawk in the vicinity. Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The Alternative 1A transmission line would also pass through the Mandeville Island-Staten Island ECA, which also has several known roost locations for greater sandhill crane. As discussed above, the transmission lines could adversely affect the movement of cranes and other bird species during periods of low visibility. The conveyance alignment at this location would be within the pipeline and thus not create a barrier to wildlife movement.

Alternative 1A temporary transmission lines would cross the *Middle River* linkage on Woodward Island. This linkage was established to guide riparian restoration along the Middle River to improve riparian connectivity for the benefit of riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite. Because this transmission line is temporary it would only temporarily conflict with the future planning for and the current movement of the avian species that use riparian corridors.

Alternative 1A conveyance facilities would create a local barrier to wildlife movement in the area between Hood and Clarksburg along the east side of the Sacramento River. The temporary and permanent transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 1A alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts (the intakes and forebay) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel; and the Clifton Court Forebay and associated canals).

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

NEPA Effects: Alternative 1A conveyance facilities would create local barriers to dispersal but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 1A would not adversely affect wildlife corridors.

CEQA Conclusion: Alternative 1A conveyance facilities would create some localized disruption in wildlife movement and the permanent and temporary transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 1A alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts (the intakes and the forebay) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel).

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the Plan Area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the Plan Area.

Alternative 1A conveyance facilities would create local barriers to dispersal and create barriers to safe movement of avian species during periods of low visibility but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 1A would result in less-than-significant impacts on wildlife corridors.

Invasive Plant Species

The invasive plant species that primarily affect natural communities in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4. Invasive species compete with native species for resources and can alter natural communities by influencing fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities covered under the BDCP could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of Alternative 1A are listed below.

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.
- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting or seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from activities listed here.

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-1A-70 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 1A.

Table 12-1A-70. Summary of Temporary Disturbance in Natural Communities under Alternative 1A

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	149
Tidal brackish emergent wetland	–
Tidal freshwater emergent wetland	7
Valley/foothill riparian	151
Nontidal perennial aquatic	37
Nontidal freshwater perennial emergent wetland	2
Alkali seasonal wetland complex	–
Vernal pool complex	–
Managed wetland	127
Other natural seasonal wetland	–
Grassland	535
Inland dune scrub	–
Cultivated lands	3,748
Total	**4,756**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Under Alternative 1A, the BDCP would have adverse effects on natural communities resulting from the introduction and spread of invasive plant species through implementation of CM1–CM10 and AMM6. No adverse effects are expected as a result of implementation of CM11–CM21.

- *CM1 Water Facilities and Operations:* Construction of the Alternative 1A water conveyance facilities would result in the temporary disturbance of 2,713 acres that would provide opportunities for colonization by invasive plant species.
- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo Bypass fisheries enhancements would result in the temporary disturbance of 758 acres that would provide opportunities for colonization by invasive plant species. Vegetation maintenance activities for the Fremont Weir and Yolo Bypass improvements may include the removal of giant reed; however, the clearing of linear areas to facilitate water flow may also result in increased opportunities for invasion. Sediment removal, transportation, and application as a source material for restoration or levee projects as part of Fremont Weir and Yolo Bypass maintenance activities could also result in the spread of invasive species if the sediment contains viable invasive plant propagules.
- *CM3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in the 11 conservation zones would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *CM4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation. Early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the BDCP Implementation Office would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the BDCP Implementation Office would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural communities restoration sites.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the temporary disturbance of 1,285 acres along channels in the north, east, and south Delta (San Joaquin, Old, and Middle Rivers) that would provide opportunities for colonization by invasive plant species.
- *CM6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.

- *CM7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *CM8 Grassland Natural Community Restoration*: The restoration of grassland habitat in CZs 1, 8 and/or 11 would result in the temporary disturbance of degraded grassland or cultivated land that would provide opportunities for colonization by invasive plant species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes in CZs 1, 8, or 11 would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of cultivated lands in CZs 2 and 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.
- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoils, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of CM11, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM11 Covered Plant Species*.

CM11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the BDCP reserve system to decrease competition with native species, thereby improving conditions for covered species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled and tidal mudflats would be maintained. In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10, and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would include the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would include methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also involve planting native species appropriate for the natural community being restored, except at some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the BDCP Implementation Office would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the other CMs, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any BDCP restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the study area. Cleaning stations would be established at the perimeter of BDCP covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

NEPA Effects: The implementation of AMM4, AMM10, AMM11, and CM11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

CEQA Conclusion: Under Alternative 1A, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing BDCP CM1-CM11 and AMM4, AMM10 and AMM11 would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be considered less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Conservation Measures with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities (CM1) and implementing CM2–CM21 for Alternative 1A have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 1A would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 1A on terrestrial biological resources are addressed under the impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the BDCP.

Federal and State Legislation

- The federal *Clean Water Act*, *Endangered Species Act*, *Fish and Wildlife Coordination Act*, *Migratory Bird Treaty Act*, *Rivers and Harbors Act* and *Marine Mammal Protection Act* all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decisionmaking. The biological goals and objectives contained in the BDCP that provide the major guidance for implementing the various conservation elements of Alternative 1A are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the Plan Area. While some of the conservation measures of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term guidance in the Plan would provide for the long-term viability and expansion of the habitats and special-status species populations in the Plan Area. Alternative 1A conservation actions would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.
- The *California Endangered Species Act*, *California Native Plant Protection Act*, *Porter-Cologne Water Quality Control Act*, and *Natural Communities Conservation Planning Act* are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. The BDCP, which is the basis for Alternative 1A, contains biological goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 1A conservation actions would be compatible with the policies and directives contained in these laws.
- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are BDCP proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The BDCP biological goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).
- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. The BDCP and its plans for protection and restoration of tidal marsh habitats in Suisun Marsh would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The BDCP is intended to become a component of the Delta Plan. The Delta Stewardship Council will determine whether the BDCP is compatible with the goals and objectives of the Delta Plan prior to its incorporation into the Plan. The compatibility of the BDCP with the Delta Plan is considered in detail in Section 13.2.2.2 of Chapter 13, *Land Use*.

- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. The BDCP conservation measures that provide for a significant expansion of wetland acreage and quality in the Delta and Suisun Marsh are compatible with the intent of the California Wetlands Conservation Policy.

- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The BDCP Plan Area includes all or portions of three Implementation Plan basins—the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

  Implementation of the Alternative 1A conservation measures would result in significant reductions in cultivated land and managed wetland acreage in the Delta, Yolo and Suisun basins; however, significant increases in tidal and nontidal wetlands in these basins would be another result. Because of the large conversion of managed wetland in the Suisun basin, the BDCP has included a large managed wetland conservation and enhancement goal for this area. For the Suisun basin conversions to be compatible with the 2006 Implementation Plan goals, this EIR/EIS has added mitigation that would require food production studies and adaptive management to ensure that the Suisun basin would continue to provide the waterfowl and shorebird habitat envisioned in the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, *Yolo Bypass Wildlife Area Land Management Plan*, *Grizzly Island Wildlife Area Management Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 1A, especially construction of CM1 and CM2 facilities, and land modification associated with CM4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the BDCP would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Yolo Bypass, on Sherman Island, and in Suisun Marsh would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. The Suisun Marsh Preservation Agreement (SMPA) was signed in 1987 and modified in 2005 by DWR, CDFW, Reclamation and the Suisun Resource Conservation District to establish the mitigation approach in the Marsh for effects of operating the SWP and CVP. The primary concerns were the effects of CVP and SWP Delta diversions on salinity in the Marsh. The SMPA focused on ways to ensure adequate water quality and quantity for the managed wetlands and wildlife habitats in the Marsh to assure equal waterfowl values in the Marsh. The Suisun Marsh Plan, for which a Final EIS/EIR was released in 2010 by these agencies, provides for restoration of tidal marsh habitat and enhancement of managed wetland in the Marsh, maintenance of waterfowl hunting and recreational opportunities in the Marsh, maintenance and improvement of the Marsh levee system, and protection and enhancement of water quality for beneficial uses of the Marsh. An integral component of the Suisun Marsh Plan is balancing continued managed wetland operation with new tidal wetland restoration to provide improved and greater habitat for fish and wildlife species. The Suisun Marsh Plan is a programmatic, long-term plan and does not include specific projects, project proponents, or funding mechanisms. However, the Suisun Marsh Plan relies on tidal restoration to allow for managed wetland operations to continue. The BDCP would provide a funding mechanism and increased management potential relative to existing and restored habitats, assisting the Suisun Marsh Plan in meeting its broader ecological goals, consistent with long-term operation of the SWP and CVP water conveyance facilities. The conservation actions contained in the BDCP, which are designed to ensure the long-term protection and recovery of special-status fish and wildlife species dependent on the Marsh, would be compatible with the water quality and habitat restoration goals of the SMPA and Suisun Marsh Plan.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the Plan's long-term control and management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that Plan objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of BDCP's conservation actions would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 1A would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans and Natural Community Conservation Plans* are the subject of a detailed analysis at the end of this chapter. The analysis considers the compatibility of the BDCP with all HCPs and NCCPs that share planning area with the BDCP Plan Area.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The BDCP proposes to protect, enhance and expand the wetlands of the Plan Area, and, therefore, would be compatible with Executive Order 11990.
- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 1A construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of mitigation measures described in this chapter would be capable of making Alternative 1A implementation compatible with Executive Order 13112.
- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 1A conservation measures that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion conservation measures of Alternative 1A would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

CEQA Conclusion: The potential plan and policy incompatibilities of implementing Alternative 1A identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of large acreages of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the *Shorebirds and Waterfowl* analysis above, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2.3 of Chapter 13, *Land Use*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and for a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

12.3.3.3 Alternative 1B—Dual Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario A)

Section 3.5.3 in Chapter 3, *Description of Alternatives*, fully describes Alternative 1B, and Figure 3-4 depicts the alternative.

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance and management associated with the Alternative 1B conservation components would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal or modification of this community (see Table 12-1B-1). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the tidal perennial aquatic natural community (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to AMMs, impacts on tidal aquatic natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Note that two time periods are represented in Table 12-1B-1 and the other tables contained in the analysis of Alternative 1B. The near-term (NT) acreage effects listed in the table would occur over the first 10 years of Plan implementation. The late long-term (LLT) effects contained in these tables represent the cumulative effects of all activities over the entire 50-year term of the Plan. This table and all impact tables in the chapter include reference to only those CMs that would eliminate natural community acreage either through construction or restoration activities, or would result in periodic inundation of the community. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the implementation schedule for all natural community protection and restoration conservation measures.

Table 12-1B-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	33	33	145	145	0	0
CM2	8	8	11	11	9–36	0
CM4	11	18	0	0	0	0
CM5	0	2	0	5	0	39
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**52**	**61**	**156**	**161**	**9–36**	**39**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently affect an estimated 61 acres and temporarily remove 161 acres of tidal perennial aquatic natural community in the study area. These modifications represent less than 1% of the 86,263 acres of the community that is mapped in the study area. The majority of the permanent and temporary effects would happen during the first 10 years of Alternative 1B implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 8,300 acres of tidal wetlands, including an estimated 3,400 acres of tidal perennial aquatic natural community during the same period, which would expand the area of that habitat and offset the losses. The 3,400-acre increase is estimated, based on modeling reported in BDCP Appendix 3.B, Table 5, by comparing existing Plan Area subtidal habitat to near-term subtidal habitat with the Plan. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.1.2) indicates that, while there would be no minimum restoration requirement for the tidal perennial aquatic natural community, an estimated approximately 27,000 acres of tidal perennial aquatic natural community would be restored based on tidal restoration modeling. This estimate is based on Table 5 in BDCP Appendix 3.B, subtracting late long-term acreage without project from late long-term acreage with project.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 33 acres and temporarily remove 145 acres of tidal perennial aquatic community. Most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland (see Terrestrial Biology Mapbook, a support document to the EIS/EIR, for a detailed view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. Small areas of this community would also be lost to canal construction approximately 1.2 miles south of Hood Franklin Road and immediately west of Stone Lakes NWR (less than 1 acre), and at crossings of a canal and connecting slough just south of Lambert Road and west of the railroad tracks. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, including in the Sacramento River at Intakes 1–5, and at temporary siphon construction work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough and Middle River just southeast of Victoria Canal. Tunnel work areas and transmission construction sites at the junction of the new canal and the new Byron Court Forebay would also temporarily affect West Canal, Grant Line Canal and Old River just south of Clifton Court Forebay. The details of these locations can be seen in the Terrestrial Biology Mapbook. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 8 acres could be permanently lost and another 11 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would affect 18 acres of tidal perennial aquatic community. CM4 involves conversion of existing natural communities to a variety of tidal wetlands, including tidal perennial aquatic, tidal brackish emergent, and tidal freshwater emergent wetlands. Specific locations for these conversions are not known. The 18 acres could remain tidal perennial aquatic with a modified tidal prism, or they could eventually be converted to one of the other tidal wetland types. For purposes of this analysis, a conservative approach has been taken and the effect has been discussed simultaneously with the habitat losses associated with other conservation measures.

  An estimated 65,000 acres of tidal wetlands and transitional uplands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic habitat would be restored, based on modeling conducted by ESA PWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration would be consistent with BDCP Objective TPANC1.1. Approximately 3,400 acres of the restoration would happen during the first 10 years of Alternative 1B implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal natural communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 2 acres and temporarily remove 5 acres of tidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the tidal perennial aquatic habitats directly affected. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on tidal perennial aquatic habitat. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the tidal perennial aquatic community through CM1 construction losses (33 acres permanent and 145 acres temporary) and the CM2 construction losses (8 acres permanent and 11 acres temporary). The habitat would be lost primarily along the Sacramento River at intake sites, at slough crossings along the eastern canal alignment, or in the northern Yolo Bypass. Approximately 11 acres of the inundation and construction-related effects resulting from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The creation of approximately 3,400 acres of high-quality tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 1B implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 248 acres of restoration would be needed to offset (i.e., mitigate) the 248 acres of effect (the total permanent and temporary near-term effects listed in Table 12-1B-1) associated with near-term activities, including water conveyance facilities construction.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in relatively minor (less than 1%) conversions or losses of tidal perennial aquatic community in the study area. These losses or conversions (101 acres of permanent and 161 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation conversions would occur over the course of the Plan's restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 27,000 acres of high-value tidal perennial aquatic natural community would be restored over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1). The restoration acreage has been estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*.

NEPA Effects: The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of BDCP implementation would offset near-term losses associated with construction activities for CM1, CM2, CM4 and CM6, avoiding any adverse effect. Alternative 1B, which includes restoration of an estimated 27,000 acres of this natural community over the course of the Plan, would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1B would result in the loss or conversion of approximately 248 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would be primarily along the Sacramento River at intake sites, at slough crossings during canal construction, and within the northern section of the Yolo Bypass, while inundation conversions would be at various tidal restoration sites throughout the study area. The losses and conversions would be spread across the 10-year near-term timeframe. These losses and conversions would be offset by planned restoration of an estimated 3,400 acres of high-value tidal perennial aquatic natural community scheduled for the first 10 years of Alternative 1B implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less-than-significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 248 acres of restoration would be needed to offset (i.e., mitigate) the 248 acres of loss or conversion. The restoration would be initiated at the beginning of Alternative 1B implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 262 acres of the natural community would be lost or converted and an estimated 27,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1B would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Two Alternative 1B conservation measures would modify the water depths and inundation regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation-related changes in water depth and velocity of 9–36 acres of tidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 9-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 36-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of the tidal perennial aquatic community occurs in the southern section of the bypass on Liberty Island, and, to a lesser extent, along the eastern edge of the bypass, including the Tule Canal/Toe Drain. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would be expected to be beneficial to the ecological function of tidal perennial aquatic habitat in the bypass as it relates to BDCP covered aquatic species. The Yolo Bypass waterway is the key element in the Yolo Bypass landscape linkage mapped in Figure 12-2 and described in detail in BDCP Chapter 3, Table 3.2-3. The change in periodic inundation in the bypass would not substantially modify its value for special-status or common terrestrial species. Water depths and water flow rates would increase over Existing Conditions and the No Action condition in approximately 30% of the years, but it would not fragment the habitat or make it less accessible to special-status or common terrestrial species. The modifications would not result in a loss of this community. The plant species associated with this community are adapted to inundation. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of these changes in the inundation regime on terrestrial species that rely on tidal perennial aquatic habitats are discussed in detail later in this chapter, under the individual species assessments.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in an increase in the frequency and duration of flooding of 39 acres of tidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The more frequent exposure of these wetlands to stream flooding events would be beneficial to the ecological function of tidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The plant species associated with these tidal perennial aquatic areas are adapted to inundation and would not be substantially modified.

In summary, 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity as a result of implementing two Alternative 1B conservation measures (CM2 and CM5). Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area; periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of tidal perennial aquatic natural community associated with Alternative 1B would not have an adverse effect on the community.

CEQA Conclusion: An estimated 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include modifications in the release of water from upstream reservoirs in the Sacramento River system, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 1B operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control* and is consistent with BDCP Objective TPANC2.1. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging.* Long-term operation of the Alternative 1B intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the tidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage and value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Brackish Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no adverse effect on the habitats associated with the tidal brackish emergent wetland natural community. Habitat restoration and construction associated with CM1, CM2, CM5 and CM6 would not remove tidal brackish emergent wetland; levee breaching and minor construction associated with CM4 may temporarily remove small amounts of this natural community (see Table 12-1B-2). Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit the tidal brackish emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create at least 6,000 acres of tidal brackish emergent wetland in Conservation Zone 11 (Objective TBEWNC1.1 associated with CM4).
- Restore connectivity to isolated patches of tidal brackish emergent marsh where isolation has reduced effective use of these marshes by the species that depend on them (Objective TBEWNC1.3 associated with CM4).
- Create topographic heterogeneity in restored tidal brackish emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TBEWNC1.4 associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1 associated with CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal brackish emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-2. Changes in Tidal Brackish Emergent Wetland Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	Unk.	Unk.	Unk.	Unk.	0	0
CM5	0	0	0	0	0	0
CM6	0	0	0	0	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	0	0

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction of the Alternative 1B water conveyance facilities (CM1) would not affect tidal brackish emergent wetland natural community.

Restoration of tidal marsh habitats associated with CM4 would require site preparation, earthwork, and other site activities that could remove tidal brackish emergent wetland. Levee modifications, grading or contouring, filling to compensate for land subsidence, and creation of new channels could also result in the removal of tidal brackish emergent wetland. All of this construction and land modification activity that could affect tidal brackish emergent wetland would occur in Suisun Marsh (CZ 11). The acreage of loss has not been calculated because the specific locations for site preparation and earthwork have not been identified, but the loss would likely be small (less than 1 acre). These activities would occur in small increments during the course of the CM4 restoration program. The restoration elements of CM4 would greatly exceed any of the short-term losses described above. At least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area (BDCP Objective TBEWNC1.1, associated with CM4), with 2,000 acres of restoration occurring in the near-term timeframe. In addition, the habitat and ecosystem functions of BDCP restored tidal brackish emergent wetland would be maintained and enhanced (CM11). The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.3.2) states that at least 6,000 acres of tidal brackish emergent wetland community would be restored in CZ 11, and that tidal natural communities restoration would decrease habitat fragmentation by providing additional connectivity between isolated patches of tidal brackish emergent wetland. These same conservation actions would be implemented under Alternative 1B.

The restoration activities associated with CM4 in Suisun Marsh would result in other effects that could alter the habitat value of tidal brackish emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Tidal flooding of dry areas could also increase the bioavailability of methylmercury in Suisun Marsh. Site-specific conditions would dictate the significance of this hazard to tidal brackish marsh vegetation and associated wildlife. According to the Suisun Marsh Plan EIR/EIS (Bureau of Reclamation et al. 2010, pg. 5.2-18), marsh creation may generate less methylmercury than is currently being generated by managed wetlands. However, this has not been confirmed through comprehensive studies. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh.

Water temperature fluctuations in newly created marsh and the potential for increased nitrogen deposition associated with construction vehicles are also issues of concern that are difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal brackish emergent wetland in the study area.

NEPA Effects: The increase of tidal brackish emergent wetland associated with CM4 would be a beneficial effect on the natural community.

CEQA Conclusion: Tidal brackish emergent wetland natural community could experience small losses in acreage in Suisun Marsh (CZ 11) as a result of the large-scale tidal marsh restoration planned as part of CM4. These losses (expected to not exceed 1 acre) would be associated with levee modification, site preparation and other earthwork needed to expose diked lands to tidal influence. Because at least 6,000 acres of tidal brackish emergent wetland would be restored in the study area as part of CM4, including 2,000 acres restored in the near-term timeframe, there would be a large increase in tidal brackish emergent wetland both in the near-term and over the life of the Plan. Indirect effects associated with the expansion of tidal brackish emergent wetland natural community, including the potential spread of invasive species, the generation of methylmercury, increases in marsh water temperatures, and increased nitrogen deposition are not expected to have a significant impact on this natural community in the study area. Therefore, this impact would be beneficial.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with CM4 of Alternative 1B are constructed and the water management practices associated with changed reservoir operations, diversions from the north Delta and marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions would involve water releases and diversions, access road and levee repair, replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta

channels would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh channels would be expected to increase with reduced Sacramento River outflows (see Chapter 8, Section 8.3.3.9), but this change would not be sufficient to change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3 for a detailed analysis of this issue). Alternative 1B, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50+ years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road and levee repair.* Periodic repair of access roads and levees associated with the BDCP actions has the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment would be a periodic activity associated with the long-term maintenance of restoration sites (*CM11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

- *Channel dredging.* Long-term maintenance of tidal channels that support wetland expansion in Suisun Marsh would include periodic dredging of sediments. The dredging would take place adjacent to tidal brackish emergent wetland natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value in the short term for special-status and common species that rely on it for cover, movement corridor or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, channel dredging and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the tidal brackish emergent wetland natural community within the study area. There would be no adverse effect on the tidal brackish emergent wetland natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes (not exceeding 1 acre) in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand tidal brackish emergent wetland natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of small acreages of this community (see Table 12-1B-3). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the tidal freshwater emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the 65,000 acres of tidal natural communities, restore or create at least 24,000 acres of tidal freshwater emergent wetland in Conservation Zones 1, 2, 4, 5, 6 and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Restore tidal freshwater emergent wetlands in areas that increase connectivity among conservation lands (Objective TFEWNC1.2, associated with CM4).
- Restore and sustain a diversity of marsh vegetation that reflects historical species compositions and high structural complexity (Objective TFEWNC2.1, associated with CM4).

- Create topographic heterogeneity in restored tidal freshwater emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TFEWNC2.2, associated with CM4).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3, that would improve the value of tidal freshwater emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-3. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	8	8	11	11	0	0
CM2	6	6	0	0	24–58	0
CM4	1	1	0	0	0	0
CM5	0	1	0	1	0	3
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**15**	**16**	**11**	**12**	**24–58**	**3**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 16 acres and temporarily remove 12 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 10 years of Alternative 1B implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add at least 24,000 acres of high value tidal freshwater emergent wetland natural community during the course of the Plan restoration activities, which would expand the area of that habitat and offset the losses. The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.4.2) states that the implementation of *CM4 Tidal Natural Communities Restoration* would restore at least 24,000 acres of tidal freshwater emergent wetland community in Cache Slough (Conservation Zones 1, 2, and 3), the

Cosumnes/Mokelumne (Conservation Zone 4), West Delta (Conservation Zone 5 and 6), and South Delta (Conservation Zone 7) ROAs. The BDCP evaluation also states that the objectives in the Plan would promote vegetation diversity and structural complexity (as incorporated into the restoration design) in restored tidal freshwater marsh. These same conservation activities would be implemented under Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 8 acres and temporarily remove 11 acres of tidal freshwater emergent wetland community. Permanent losses would occur as a result of constructing the east canal. Small areas of emergent wetland would be removed where the canal would cross manmade channels just south of Hood and at Lambert Road in the north Delta. Permanent losses would also occur at canal crossings of Beaver Slough and a channel just north of White Slough in the east Delta. The temporary losses would be associated primarily with siphon construction where the canal would cross White Slough, Disappointment Slough, and Middle River just south of Victoria Canal. Small temporary losses would also occur where a tunnel would be constructed under Old River just north of its junction with Victoria Canal, and where transmission lines would be constructed south of the new forebay adjacent to Clifton Court Forebay. Refer to the Terrestrial Biology Mapbook to see the details of these locations. These losses would take place during the near-term construction period.

  There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of CM1. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities,* addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction or channel modification activities within the Yolo and Sacramento Bypasses, including improvements in flow through the west side channel of the bypass, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in tidal freshwater emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 6 acres could be permanently lost to these activities. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on hypothetical footprints of this restoration activity, initial land grading and levee modification could permanently remove 1 acre of tidal freshwater emergent wetland natural community. This loss would occur during the near-term timeframe throughout the ROAs identified for tidal wetland restoration. At the same time, an estimated 24,000 acres of tidal freshwater emergent wetland community would be restored during tidal habitat restoration, consistent with BDCP Objective TFEWNC1.1, associated with CM4. Approximately 8,850 acres of the restoration would occur during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal wetland communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Restoration would be located and designed to improve habitat connectivity (Objective TFEWNC1.2), improve marsh species diversity (Objective TFEWNC2.1), and provide variation in inundation characteristics (Objective TFEWNC2.2). Some of the restoration would happen in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- The restoration activities associated with CM4 in the Plan Area ROAs would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal freshwater marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough, Cosumnes/Mokelumne and Suisun Marsh ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.*CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater emergent wetland habitat. The construction-related losses would be considered a permanent removal of the habitats directly affected. The majority of seasonally inundated floodplain restoration is expected to be implemented along the lower San Joaquin River in the south and central Delta areas. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on freshwater marsh and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would take place on narrow strips of habitat, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that would offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the tidal freshwater emergent wetland natural community through CM1 construction losses (8 acres permanent and 11 acres temporary), CM2 construction losses (6 acres permanent), and CM4 construction losses (1 acre permanent). The tidal freshwater emergent wetland natural community would be lost in the north Delta near Hood, in the east Delta at various slough crossings, in the south Delta near the new forebay, and at various locations within the Yolo Bypass and the tidal restoration ROAs.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 1B implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 26 acres of restoration would be needed to offset (i.e., mitigate) the 26 acres of loss (the total permanent and temporary near-term effects listed in Table 12-1B-3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in relatively minor (less than 1%) losses of tidal freshwater emergent wetland community in the study area. These losses (16 acres of permanent and 12 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and levee modification and land grading for tidal marsh restoration (CM4) and floodplain restoration (CM5). The CM4 and CM5 losses would occur during the course of the CM4 and CM5 conservation actions at various tidal and floodplain restoration sites throughout the study area. By the end of the Plan timeframe, a total of 24,000 acres of this natural community would be restored over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of BDCP implementation would offset the construction and inundation-related effects of implementing CM1, CM2, CM4 and CM5, avoiding any adverse effect in the near-term. Because of the 24,000 acres of tidal freshwater emergent wetland restoration that would occur over the course of the Plan, Alternative 1B would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1B would result in the near-term loss of approximately 26 acres of tidal freshwater emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), tidal marsh restoration (CM4), and floodplain restoration (CM5). The construction losses would occur in the north Delta near Hood, in the east Delta at several slough crossings and in the south Delta at the new forebay. The losses would be spread across a 10-year near-term timeframe and would be offset by planned restoration of 8,850 acres of tidal freshwater emergent wetland natural community scheduled for the first 10 years of Alternative 1B implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less-than-significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 26 acres of restoration would be needed to offset (i.e., mitigate) the 26 acres of loss (the combination of the near-term permanent and temporary losses included in Table 12-1B-3). The restoration would be initiated at the beginning of Alternative 1B implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 28 acres of tidal freshwater emergent wetland natural community would be lost to conservation activities, and 24,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1B would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal freshwater emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation of 24–58 acres of tidal freshwater emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently inundated would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 24-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 58-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of this community occurs in the southern section of the bypass on Liberty Island, on the fringes of tidal perennial aquatic habitats. Smaller areas are scattered among the cropland within the bypass, south of Interstate 80. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of tidal freshwater emergent wetland habitats and would not substantially modify its value for special-status or common terrestrial species. The plants in this natural community are adapted to periodic inundation events within the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in a seasonal increase in the frequency and duration of inundation of 3 acres of tidal freshwater emergent wetland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused along the major rivers and Delta channels in the south Delta. The reconnection of these wetlands to stream flooding events would be beneficial to the wetlands' ecological function, especially as they relate to the BDCP's target terrestrial and aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1B conservation measures (CM2 and CM5). Tidal freshwater emergent wetland natural community is a habitat of great value to both terrestrial and aquatic species in the study area, and increases in inundation for relatively short periods of time would not reduce the acreage or the value of this community.

NEPA Effects: Periodic inundation would not result in a net permanent reduction in the acreage and value of the tidal freshwater emergent wetland natural community in the study area. Therefore, there would be no adverse effect.

CEQA Conclusion: An estimated 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. This community is of great value to aquatic and terrestrial species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage and value of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-7 for effects associated with CM2). The periodic actions would involve access road and conveyance facilities repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1B would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a significant reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3 for a detailed analysis of this issue). Alternative 1B, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50+ years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1B intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would be done in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B, including changed water operations in the upstream rivers, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1B-4). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the valley/foothill riparian natural community.

- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7 by year 10 (ObjectiveVFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5 and CM7).
- Maintain 500 acres of mature riparian forest in Conservation Zones 4 or 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to late-successional riparian vegetation (VFRNC2.2,) in large blocks with a minimum patch size

of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

- Maintain or increase abundance and distribution of valley/foothill riparian natural community vegetation alliances that are rare or uncommon as recognized by California Department of Fish and Game (2010), such as button willow thickets alliance and blue elderberry stands alliance (Objective VFRNC3.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3, that would improve the value of valley/foothill riparian natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-4. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	51	51	39	39	0	0
CM2	89	89	88	88	51–92	0
CM4	298	552	0	0	0	0
CM5	0	43	0	35	0	266
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**438**	**735**	**127**	**162**	**51–92**	**266**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 735 acres and temporarily remove 162 acres of valley/foothill riparian natural community in the study area. These modifications represent approximately 5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 10 years of Alternative 1B implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Valley/foothill riparian protection (750 acres) and restoration (800 acres) would be initiated during the same period. By the end of the Plan period, 5,000 acres of this natural community would be restored. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.5.2) indicates that implementation of Alternative 4 would restore or create 5,000 acres of riparian forest and scrub in Conservation Zones 1, 2, 4, 5, 6, and 7, with at least 3,000 acres occurring on restored seasonally inundated floodplain. Alternative 4 would also protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7. These conservation measures would also be implemented under Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 51 acres and temporarily remove 39 acres of valley/foothill riparian natural community. The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation (see Terrestrial Biology Mapbook). Other small patches or narrow bands of riparian vegetation dominated by valley oak, willow, cottonwood or mixed brambles would be permanently removed by canal construction adjacent to Intake 1, between Intakes 2 and 4, and just south of Lambert Road. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. A small area of riparian habitat (mostly blackberries) would be permanently removed in the south Delta at the new forebay construction site. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal. Tunnel construction at Old River just south of Victoria Canal would also temporarily remove mixed willows and brambles. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 89 acres could be permanently lost and another 88 acres could be temporarily removed. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. This vegetation is a mix of valley oak, sycamore, cottonwood and willow trees. The riparian areas here are primarily small, disconnected patches with moderate to low value as wildlife movement corridors. Most of these patches lack structural complexity. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would remove similar linear strips of vegetation. These losses would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 552 acres of valley/foothill riparian community. The losses would be spread among most of the ROAs

established for tidal restoration (see Figure 12-1). No losses would occur from Suisun Marsh restoration. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (BDCP Chapter 5, Section 5.4.5.1.1). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted by use of the theoretical footprint. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration levee construction would permanently remove 43 acres and temporarily remove 35 acres of valley/foothill riparian natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration:* The valley/foothill riparian natural community would be restored primarily in association with the tidal (CM4) and floodplain (CM5) restoration and channel margin enhancements. Following community-specific goals and objectives in the Plan, a total of 5,000 acres of this community would be restored (BDCP Objective VFRNC1.1) and 750 acres would be protected (BDCP Objective VFRNC1.2) over the life of the Plan. Approximately 800 acres would be restored and the entire 750 acres would be protected during the first 10 years of Plan implementation. Riparian restoration and protection would be focused in CZ 4 and CZ 7 (BDCP Objective VFRNC2.3), with a goal of adding a 500-acre portion of the restoration in one or the other of these zones. A variety of successional stages would also be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area (BDCP Objective VFRNC2.4).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the valley/foothill riparian natural community through CM1 construction losses (51 acres permanent and 39 acres temporary) and the CM2 construction losses (89 acres permanent and 88 acres temporary). The natural community would be lost primarily along the eastern bank of the Sacramento River at intake sites, along the eastern canal route in the northern and eastern Delta areas, in the vicinity of the new forebay construction site in the south Delta, and in the northern Yolo Bypass. Approximately 298 acres of the inundation and construction-related loss from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with BDCP conservation components. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined by Section 404 of the CWA. Most of the losses would be in small patches or narrow strips along waterways, with limited structural complexity. The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of BDCP implementation would minimize this near-term loss, avoiding an adverse effect. At least 400 acres of the protection is planned for the first 5 years of Alternative 1B implementation. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 565 acres of protection and 565 acres of restoration would be needed to offset (i.e., mitigate) the 565 acres of loss (the combination of permanent and temporary losses in the near-term listed in Table 12-1B-4). The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in 6% losses of valley/foothill riparian community in the study area. These losses (735 acres of permanent and 162 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 5,000 acres of this natural community would be restored and 750 acres would be protected (CM7 and CM3, respectively). The restoration would occur primarily in CZ 4 and CZ 7, in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

NEPA Effects: The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of BDCP implementation would minimize the near-term loss of this community, avoiding any adverse effect. Because of the Plan's commitment to restoration of 5,000 acres and protection of 750 acres of valley/foothill riparian natural community during the course of the Plan, Alternative 1B would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1B would result in the near-term loss of approximately 565 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The natural community would be lost primarily along the Sacramento River at intake sites, along the eastern canal route in the northern and eastern Delta areas, in the vicinity of the new forebay construction site in the south Delta, and within the northern section of the Yolo Bypass, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe. These losses would be minimized by planned restoration of 800 acres (CM7) and protection (including significant enhancement) of 750 acres (CM3) of valley/foothill riparian natural community scheduled for the first 10 years of BDCP implementation. At least 400 acres of the protection is planned for the first 5 years of Plan implementation. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts. Because of these near-term restoration and protection activities and AMMs, impacts would be less-than-significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 565 acres of protection and 565 acres of restoration would be needed to offset (i.e., mitigate) the 565 acres of loss. The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of Plan implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 897 acres of valley/foothill riparian natural community would be permanently or temporarily removed by conservation actions, 5,000 acres would be restored and 750 acres would be protected. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1B would not have a substantial adverse effect on this natural community; the impact on the valley/foothill riparian natural community would be beneficial.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of valley/foothill riparian natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement:* Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation of 51–92 acres of valley/foothill riparian natural community. The area more frequently inundated would vary with the flows that would be passed through the newly-constructed notch in the Fremont Weir. The 51 acres would be created by a notch flow of 8,000 cfs and the 92 acres would be created by a notch flow of 4,000 cfs. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. These increased flow conditions would be expected to occur in no more than 30% of all years (see BDCP Chapter 5, Section 5.4.1.2). The valley/foothill riparian community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass. There are other riparian habitat areas on Liberty Island, and, to a lesser extent, along the eastern and western edges of the bypass, including along the Tule Canal/Toe Drain, the west side channels and the Sacramento Bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect riparian habitats, as they have persisted under similar high flows and extended inundation periods in the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in an increase in the frequency and duration of inundation of 266 acres of valley/foothill riparian habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 3-1). The reconnection of riparian vegetation to periodic stream flooding events would be beneficial to the ecological function of this natural community, especially in the germination and establishment of native riparian plants as flood scour increases.

In summary, from 317 to 368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1B conservation measures (CM2 and CM5). The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. The increased inundation would create a beneficial effect on the community as it relates to germination and establishment of native riparian plants.

NEPA Effects: Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial effect on the community.

CEQA Conclusion: An estimated 317 to 368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial impact on the community.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see Impact BIO-10 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with Alternative 1B, as compared with no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with Operational Scenario A) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced by as much as 19% in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 48% with implementation of Alternative 1B. Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 11–27% compared with No Action, depending on month and water-year type (see Section 11C.4 in Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

  The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1B would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles.

These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1B intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and*

Management (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat. The BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM18 and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on this community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM18 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration and protection activities associated with *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of

CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1B-5). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the nontidal perennial aquatic natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-5. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	19	19	5	5	0	0
CM2	24	24	12	12	50–77	0
CM4	34	189	0	0	0	0
CM5	0	28	0	16	0	25
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**77**	**260**	**17**	**33**	**50–77**	**25**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 260 acres and temporarily remove 33 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 5% of the 5,567 acres of the community that is mapped in the study area. Approximately one-third (94 acres) of the permanent and temporary losses would occur during the first 10 years of BDCP implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration (CM10) would add 400 acres of nontidal marsh during the same period, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh, and that the restoration would occur in blocks that would be contiguous with the Plan's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation actions would be implemented for Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 1B water conveyance facilities would permanently remove 19 acres and temporarily remove 5 acres of nontidal perennial aquatic community. The permanent losses would occur where the new canal would cross existing irrigation canals at the junction of Blossom Road and West Peltier Road, and just south of Sycamore Slough, and where it would eliminate a small slough just south of the San Joaquin River at its junction with Fourteen Mile Slough. These locations are all in the east Delta. The temporary losses would occur where nontidal canals or sloughs would be affected at canal siphon construction sites adjacent to Hog Slough, Sycamore Slough and Railroad Cut (see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels modifications, Putah Creek realignment activities, and Sacramento Weir and Tule Canal improvements. All of these activities could involve excavation and grading in nontidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently lost and another 12 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently change to tidally influenced inundation or remove 189 acres of nontidal perennial aquatic community. These losses would be expected to occur primarily in the Cache Slough and Cosumnes/Mokelumne ROAs (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored. Approximately 400 acres of the restoration (CM10) would occur during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction and early restoration activities. The remaining restoration would be spread over the following 30 years. Nontidal natural communities restoration is expected to be focused in CZs 2, 4 and/or 5 in Figure 12-1.

- *CM5 Seasonally Inundated Floodplain Restoration:* Based on theoretical footprints, floodplain restoration levee construction would permanently remove 28 acres and temporarily remove 16 acres of nontidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the nontidal perennial aquatic habitats. It is expected that floodplain restoration would be focused on the south part of the Plan Area, in CZ 7. Floodplain restoration along the southern Delta rivers would improve connectivity for a variety of species that rely on aquatic and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River, Middle River and Old River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would be on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. Channel margin would be enhanced within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the nontidal perennial aquatic community through CM1 construction losses (19 acres permanent and 5 acres temporary) and the CM2 construction losses (24 acres permanent and 12 acres temporary). The natural community would be lost at scattered locations along the canal construction corridor in the east and south Delta and along the west side channels and channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. Approximately 34 acres of the inundation and construction-related losses from CM4 would occur during the near-term throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, the creating 400 acres of nontidal marsh as part of CM10 during the first 10 years of BDCP implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 94 acres of restoration and 94 acres of protection would be needed to offset (i.e., mitigate) the 94 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in relatively minor (5%) losses of nontidal perennial aquatic community in the study area. These losses (260 acres of permanent and 31 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), change to tidally influenced inundation during tidal marsh restoration (CM4), and floodplain restoration (CM5). The changes to tidally influenced inundation would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored over a wide region of the study area, including within the Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: During the first 10 years of implementing Alternative 1B, creating 400 acres of nontidal marsh as part of CM10 would offset the construction-related and inundation losses of 94 acres of nontidal perennial aquatic natural community. There would be no adverse effect. During the full duration of Plan implementation, Alternative 1B would not result in a net reduction in the acreage of a sensitive natural community; there would be an expansion of nontidal marsh and the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1B would result in the loss of approximately 94 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The natural community would be lost at scattered locations along the canal construction corridor in the east and south Delta and along the west side channels and channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres of nontidal marsh scheduled for the first 10 years of BDCP implementation (CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 94 acres of restoration and 94 acres of protection would be needed to offset (i.e., mitigate) the 94 acres of loss. While the Plan does not include protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection. The restoration would be initiated at the beginning of Alternative 1B implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 293 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. The nontidal marsh would consist of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1B would not have a substantial adverse effect on this natural community; the impact on the nontidal perennial aquatic natural community would be beneficial.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional inundation as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation of 50–77 acres of nontidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 50-acre increase in inundation would be associated with a notch flow of 3,000 cubic feet per second (cfs), and the 77-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and patches throughout the bypass, including along the Tule Canal/Toe Drain, the western channels north of Interstate 80, and below the Fremont and Sacramento Weirs. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 25 acres of nontidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The periodic flooding may also encourage germination of nontidal marsh vegetation.

In summary, from 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1B conservation measures (CM2 and CM5). Nontidal perennial aquatic natural community in the Yolo Bypass has developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal perennial aquatic natural community in the Yolo Bypass and along south Delta waterways would not reduce the acreage of this natural community and could encourage germination of aquatic vegetation. This increased inundation would not be adverse.

CEQA Conclusion: An estimated 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. Nontidal perennial aquatic community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with CM1 (see Impact BIO-13 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 1B operations scheme would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are

not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. (*CM11 Natural Community Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1B-6). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the nontidal freshwater perennial emergent wetland natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal freshwater perennial emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-6. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	5	5	6	6	0	0
CM2	25	25	1	1	6–8	0
CM4	40	99	0	0	0	0
CM5	0	0	0	0	0	8
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**70**	**129**	**7**	**7**	**6–8**	**8**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 129 acres and temporarily remove 7 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 9% of the 1,509 acres of the community that is mapped in the study area. Approximately 57% (77 acres) of the permanent and temporary losses would happen during the first 10 years of BDCP implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration (CM10) would add 1,200 acres of nontidal marsh, consistent with BDCP Objective NFEW/NPANC1.1, and natural communities protection (CM3) would protect 50 acres of nontidal marsh, consistent with BDCP

Objective TRBL1.1. These actions would be taken over the course of BDCP marsh restoration activities, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. The nontidal marsh protection would be designed to support tricolored blackbird populations in the study area. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh. The restoration would occur in blocks that would be contiguous with the alternative's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). These conservation actions would also be implemented under Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 5 acres and temporarily remove 6 acres of tidal freshwater perennial emergent wetland community. The permanent loss would occur where the new canal would cross a small channel with emergent wetland just south of the San Joaquin River and adjacent to North Holt Road, immediately west of Stockton. The temporary loss would occur where temporary siphon and railroad work areas would displace emergent wetlands in and adjacent to Railroad Cut at Holt (see Terrestrial Biology Mapbook). These wetlands are extremely small and remote water bodies. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels and Tule Canal modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in nontidal freshwater perennial emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 25 acres could be permanently lost and 1 acre could be temporarily removed. These losses would most likely occur in the Tule Canal and west side channels at the north end of the bypass. The habitat here includes narrow bands within these side channels of the bypass and is isolated from other marsh or open water habitats. The narrow bands are bordered by riparian habitats, primarily willows and cottonwoods. This activity would occur in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 99 acres of nontidal freshwater perennial emergent wetland community. These losses would be expected to occur primarily in the Cache Slough ROA (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored (CM10) and 50 acres would be protected (CM3) during nontidal habitat conservation actions. Approximately 400 acres of the restoration and 25 acres of the protection would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction and early tidal marsh restoration. The remaining restoration would be spread over the following 30 years. Nontidal marsh natural communities restoration is expected to be focused in the vicinity of giant garter snake populations in the eastern Delta and near the Yolo Bypass. *CM5 Seasonally Inundated*

Floodplain Restoration: Based on theoretical footprints, floodplain restoration levee construction would not affect nontidal freshwater perennial emergent wetland natural community.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the nontidal freshwater perennial emergent wetland community through CM1 construction losses (5 acres permanent and 6 acres temporary) and the CM2 construction losses (25 acres permanent and 1 acre temporary). These losses would occur along the eastern canal route just south of the San Joaquin River and adjacent to North Holt Road, and just north of Holt in the south Delta, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 during the first 10 years of BDCP implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 77 acres of restoration and 77 acres of protection would be needed to offset (i.e., mitigate) the 77 acres of loss (the combination of temporary and permanent near-term losses included in Table 12-1B-6). While the Plan includes just 25 acres of protection in the near-term, it includes in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM*6 *Disposal and Reuse of Spoils, AMM*7 *Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in 9% losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (129 acres of permanent and 7 acres of temporary loss) would be associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored and 50 acres would be protected. The restoration would occur near giant garter snake occupied habitat in the eastern Delta and near Yolo Bypass, in CZs 2, 4 and 5. The 50 acres of protection would occur in CZ 1, 2, 8 or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: In the near-term, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 would offset the near-term losses associated with construction of CM1, CM2 and CM4 facilities, avoiding any adverse effect. With 1,200 acres of nontidal marsh restoration (BDCP Objective NFEW/NPANC1.1) and 50 acres of protection (BDCP Objective TRBL1.1) included with full implementation of the Plan, Alternative 1B would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1B would result in the loss of approximately 77 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur along the eastern canal route at and just north of Holt in the south Delta, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur throughout several of the ROAs mapped in Figure 12-1.

The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres and protection of 25 acres of nontidal marsh scheduled for the first 10 years of BDCP implementation (CM3 and CM10). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less-than-significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 77 acres of restoration and 77 acres of protection would be needed to offset (i.e., mitigate) the 77 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection. The restoration and protection would be initiated at the beginning of Alternative 1B implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 136 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. There would be no net permanent reduction in the acreage of the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, Alternative 1B would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal freshwater perennial emergent wetland natural community on small acreages, while CM5 would expose this community to additional inundation as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency and duration of inundation of 6-8 acres of nontidal freshwater perennial emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 6-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 8-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and isolated patches along the Tule Canal and western channel in the north end of the bypass. These areas are not connected to other adjacent marsh and open water habitats; they are surrounded by riparian habitat, scoured grassland and agricultural lands. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal freshwater perennial emergent wetland plant species in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this increased inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 8 acres of nontidal freshwater perennial emergent wetland habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal freshwater perennial emergent wetland habitats, especially as they relate to BDCP target aquatic species. The added exposure to inundation could also encourage germination of nontidal marsh plant species. Foraging activity

and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 14-16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1B conservation measures (CM2 and CM5). This community would not be adversely affected because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal freshwater perennial emergent wetland natural community in the Yolo Bypass and in the southern Delta would not reduce the acreage of this natural community and could encourage germination of emergent wetland vegetation. The increased inundation would not be an adverse effect.

CEQA Conclusion: An estimated 16-18 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. This community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-16 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM*4 *Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*)*.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure control plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal freshwater perennial emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance, and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of CM2 and CM4 would result in permanent removal of this community (see Table 12-1B-7). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the alkali seasonal wetland natural community.

- Protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8 and/or 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in Conservation Zones 1, 8, and/or 11 to achieve no net loss of wetted acres (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of alkali seasonal wetland natural community for terrestrial species. As explained below, with the protection, restoration, and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-7. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	45	45	0	0	264–744	0
CM4	13	27	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**58**	**72**	**0**	**0**	**264–744**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM2 and CM4 would permanently eliminate an estimated 72 acres of alkali seasonal wetland complex natural community in the study area. These modifications represent approximately 2% of the 3,723 acres of the community that is mapped in the study area. Most of the losses (58 acres or 80%) would occur during the first 10 years of Alternative 1B implementation, as Yolo Bypass improvements and habitat restoration is initiated. Alkali seasonal wetland complex protection (120 acres) and restoration (an estimated 58 acres, but determined by actual level of effect) would be initiated during the same period; when combined, these actions would offset the losses. By the end of the Plan period, 150 acres of this natural community would be protected and up to 72 acres would be restored. The BDCP beneficial effects analysis for this community (BDCP Chapter 5, Section 5.4.7.2) states that Alternative 4 would protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, or 11, in a mosaic of protected grasslands and vernal pool complex. This would protect currently unprotected high-value alkali seasonal wetland complex in the Plan Area. The same conservation actions would be implemented for Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would not directly affect alkali seasonal wetland complex natural community.

  The construction activity associated with CM1 has the potential to lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Realignment of Putah Creek could involve excavation and grading in alkali seasonal wetland complex as a new channel is constructed. Based on hypothetical construction footprints, a total of 45 acres could be permanently lost. This complex is located immediately south of the existing Putah Creek channel within the bypass, and is a relatively large, moderate to high value, contiguous expanse of this community. This loss would occur in the near-term timeframe.

- *CM3 Natural Communities Protection and Restoration:* CM3 proposes to protect at least 150 acres of alkali seasonal wetland complex in CZ 1, CZ 8 and CZ 11 (BDCP Objective ASWNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13 acres of alkali seasonal wetland complex in the near-term and inundate or remove 27 acres by the end of the Plan timeframe. The losses would be expected to occur in the Cache Slough and Suisun Marsh ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the Lindsay Slough area and on the northern fringes of Suisun Marsh, north of the Potrero Hills. These losses would not fragment the alkali seasonal wetland communities adjacent to these sloughs because the losses would occur on the edges of the existing habitat.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the conservation measure is to match the acreage of restoration with the actual acreage lost to other conservation measures (primarily CM2 and CM4). The current estimate for alkali seasonal wetland complex restoration is 58 acres in the near-term and a total of 72 acres by the end of the BDCP's restoration period. The goal is for no net loss of this natural community, consistent with BDCP Objective ASWNC1.2. Restoration in the Lindsay Slough area of the Cache Slough ROA and the northern region of the Suisun Marsh ROA would be consistent with essential habitat connectivity goals mapped in Figure 12-2 and described in Table 3.2-3 of BDCP Chapter 3.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the alkali seasonal wetland complex natural community through CM2 construction losses (45 acres). These losses would occur in the Yolo Bypass south of Putah Creek. Approximately 13 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough and Suisun Marsh ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of up to 58 acres of this community as part of CM9 during the first 10 years of BDCP implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres of restoration would be needed to offset (i.e., mitigate) the 58 acres of loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in 2% losses of alkali seasonal wetland natural community in the study area. These losses (72 acres) would be largely associated with construction of Yolo Bypass fish improvements (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities, primarily in the Cache Slough and Suisun Marsh ROAs.

***NEPA Effects*:** In the first 10 years of implementing Alternative 1B conservation measures, 120 acres of alkali seasonal wetland complex would be protected and up to 58 acres would be restored. These conservation actions would offset the near-term losses associated with construction and restoration actions of CM2 and CM4, avoiding any adverse effect. By the end of the Plan timeframe, a total of 150 acres of this natural community would be protected (BDCP Objective ASWCNC 1.1 and CM3) and an estimated 72 acres would be restored (BDCP Objective ASWNC1.2 and CM9). The protection and restoration would occur primarily in CZ 1, CZ 8, and/or CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Therefore, Alternative 1B would not have an adverse effect on this natural community.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1B would result in the permanent loss of approximately 58 acres of alkali seasonal wetland complex natural community due to construction of fish passage improvements (CM2) and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily in the area just south of Putah Creek in the Yolo Bypass, while inundation losses would occur in the Cache Slough and Suisun Marsh ROAs. The losses would be spread across a 10-year near-term timeframe.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of up to 58 acres of this community as part of CM9 during the first 10 years of BDCP implementation would offset this near-term loss, avoiding any significant impact. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres or restoration would be needed to offset (i.e., mitigate) the 58 acres of loss. AMM1, AMM2, AMM3, AMM4, and AMM10 would also be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 72 acres of alkali seasonal wetland complex natural community would be permanently removed by conservation actions, 150 acres would be protected and up to 72 acres would be restored. The restoration acres actually developed would depend on the number of acres affected during Plan implementation. There would be no net permanent reduction in the acreage of this natural community within the study area. Therefore, Alternative 1B would have a less-than-significant impact on this natural community.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Complex Natural Community

BDCP conservation measure CM2 would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of alkali seasonal wetland complex natural community at scattered locations in the central and southern sections of the bypass.

Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency and duration of inundation on an estimated 264–744 acres of alkali seasonal wetland complex natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 264-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 744-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The alkali seasonal wetland complex natural community occurs primarily in the central and southern reaches of the bypass, south of Putah Creek. The stands in this location are relatively large, with moderate to high value for associated plant and wildlife species. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1B would not adversely affect alkali seasonal wetland complex habitats, as they have persisted under similar high flows and extended flooding periods. There is the potential for some change in plant species composition as a result of longer inundation periods, but the natural community would persist.

CEQA Conclusion: An estimated 264–744 acres of alkali seasonal wetland complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1B. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of alkali seasonal wetland complex natural community in the Yolo Bypass would have a less-than-significant impact on this community. The effects of this inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation in and adjacent to Plan reserves. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *CM3 Natural Communities Protection and Restoration, and CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM37.The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the Alternative 1B conservation components would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Initial development and construction of CM4 would result in permanent removal of 1 acre of this community (see Table 12-1B-8). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the vernal pool complex natural community.

- Protect 600 acres of existing vernal pool complex in Conservation Zones 1, 8, and 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in Conservation Zones 1, 8, and/or 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of vernal pool complex natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-8. Changes in Vernal Pool Complex Natural Community Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	4	4	0	0	0	0
CM2	0	0	0	0	0–4	0
CM4	201	372	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**205**	**376**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1 and CM4 would permanently eliminate an estimated 376 acres of vernal pool complex natural community in the study area. This modification represents approximately 3% of the 12,133 acres of the community that is mapped in the study area. These acreages are based on the proposed location of the CM1 construction footprint and a theoretical footprint for CM4 tidal marsh restoration activities. An estimated 205 acres of this loss would occur during the first 10 years of Alternative 1B implementation, as water conveyance facilities are constructed and tidal marsh restoration is initiated. Vernal pool complex protection (400 acres) and restoration (an estimated 40 acres, with actual restoration based on level of effect) would be initiated during the first 10 years of Alternative 1B implementation to counteract the loss of habitat. By the end of the Plan period, 600 acres of this natural community would be protected and up to 67 acres would be restored. Because of the high sensitivity of this natural community and its shrinking presence in the Plan Area, avoidance and minimization measures have been built into the BDCP to eliminate the majority of this potential loss. The BDCP beneficial effect analysis (BDCP Chapter 5, Section 5.4.8.2) indicates that implementation of Alternative 4 would protect at least 600 acres of vernal pool complex in Conservation Zones 1, 8, and 11 and additional vernal pool complex would be restored to achieve no net loss of this community. These conservation activities would also be implemented under Alternative 1B.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 4 acres of vernal pool complex natural community. The loss would occur from construction of Alternative 1B's expanded forebay, immediately adjacent to Clifton Court Forebay at its southwest corner (see Figure 12-1 and Terrestrial Biology Mapbook). The habitat here is isolated hydrologically from other vernal pool complex by the existing forebay, the California Aqueduct and agricultural operations. The habitat is of low value and is made up of degraded vernal pool complex with ruderal herbaceous grasses and forbs, and patches of iodine bush.

  Because of the close proximity of construction activity to adjacent vernal pool complex, both near Clifton Court Forebay and Stone Lakes National Wildlife Refuge, there is also the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis later in this chapter.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay and Stone Lakes National Wildlife Refuge. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay and east of the construction areas adjacent to Stone Lakes NWR. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related*

Nitrogen Deposition on BDCP Natural Communities, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. At Stone Lakes National Wildlife Refuge, the USFWS refuge management undertakes active invasive species control, including use of grazing. No adverse effect is expected.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 600 acres of vernal pool complex in CZ 1, CZ 8, and CZ 11 (BDCP Objective VPNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.
- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 tidal marsh restoration in CZs 1 and 11 (Cache Slough and Suisun Marsh ROAs; see Figure 12-1) could permanently inundate or remove 201 acres of vernal pool complex in the near-term timeframe. By the end of the Plan period, a total of 372 acres could be affected. The principal areas likely to be affected include the Cache Slough drainage just west of the Yolo Bypass and the Nurse Slough drainage just east of the Potrero Hills.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool and alkali seasonal wetland complex restoration is 40 acres in the near-term and up to 67 acres by the end of the BDCP's restoration period. This restoration conservation measure includes the "no net loss" policy normally applied to this natural community (BDCP Objective VPNC1.2).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that would offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect 205 acres of vernal pool complex natural community through inundation or construction-related losses in habitat from CM1 and CM4 activities. This loss would likely occur in the Cache Slough or Suisun Marsh ROAs mapped in Figure 12-1, and in the vicinity of Clifton Court Forebay (see the Terrestrial Biology Mapbook).

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of up to 40 acres of this community (including a commitment to keep pace with actual losses) as part of CM9 during the first 10 years of Alternative 1B implementation would partially offset this near-term loss. The Plan focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 410 acres of protection and 205 acres of restoration would be needed to offset (i.e., mitigate) the 205 acres of loss. Without additional avoidance and minimization measures to reduce the potential effect, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses.

To avoid this adverse effect, the Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, and *AMM30 Transmission Line Design and Alignment Guidelines.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With these AMMs in place, and the commitment to have restoration keep pace with actual vernal pool complex loss, Alternative 1B would not adversely affect vernal pool complex natural community in the near-term.

Late Long-Term Timeframe

The late long-term effect on vernal pool complex natural community would be 376 acres of permanent loss. These losses would be associated with the construction of CM1 facilities in the vicinity of Clifton Court Forebay and the ongoing restoration of tidal wetland in the Cache Slough and Suisun Marsh ROAs. However, 600 acres would be protected (CM3) and up to 67 acres would be restored (CM9) through the course of the Alternative 1B implementation. In addition, the avoidance and minimization measures listed above would reduce the actual loss of this community to no more than 10 wetted acres of vernal pool crustacean habitat from direct activities and 20 acres of habitat from indirect effects.

***NEPA Effects*:** The conservation measures associated with Alternative 1B include protection of 400 acres (BDCP Objective VPNC 1.1 and CM3) and restoration of an estimated 40 acres (BDCP Objective VPNC1.2 and CM9) of vernal pool complex in the near-term time frame. The Plan focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). In addition, Alternative 1B includes AMM12 which limits the removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool complex natural community. With this and other AMMs in place, Alternative 1B would not adversely affect vernal pool complex natural community in the near-term. With these conservation measures and AMMs in effect through the entire Plan period, Alternative 1B would not have an adverse effect on the vernal pool complex natural community in the long term.

***CEQA Conclusion*:**

Near-Term Timeframe

During the 10-year near-term time frame, Alternative 1B could result in the direct loss of approximately 205 acres of vernal pool complex natural community due to construction of water conveyance facilities (CM1) and inundation during tidal marsh restoration (CM4). The losses would occur adjacent to Clifton Court Forebay and in the Cache Slough or Suisun Marsh ROAs. The loss would occur in the 10-year near-term timeframe.

The construction- and inundation-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (with a commitment to have restoration keep pace with actual losses) as part of CM9 during the first 10 years of Alternative 1B implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 410 acres of protection and 205 acres of restoration would be needed to offset (i.e., mitigate) the 205 acre of loss. Without additional avoidance and minimization measures to reduce the potential impact, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. However, Alternative 1B also includes AMM1, AMM2, AMM3, AMM4, AMM10, AMM12 and AMM30 to minimize impacts. AMM12 places a strict limit on the acres of wetted vernal pool crustacean habitat that can be lost to conservation actions (10 acres of direct and 20 acres of indirect loss; equivalent to approximately 67 acres of direct and 134 acres of indirect loss of vernal pool complex natural community). Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 376 acres of vernal pool complex natural community could be permanently removed. Through CMs 3 and 9, 600 acres of vernal pool complex natural community would be protected and up to 67 acres would be restored. In addition, AMM12 would limit the acres of wetted vernal pool crustacean habitat loss to 10 acres from direct actions and 20 acres from indirect actions. There would be no net permanent reduction in the acreage of this natural community within the study area. Alternative 1B would have a less-than-significant impact on this natural community.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

CM2 would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, could increase periodic inundation of a small acreage of vernal pool complex natural community in the southern section of the bypass, south of Putah Creek.

Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation on an estimated 0–4 acres of vernal pool complex natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 4-acre increase in inundation would only occur at the highest modeled flow regime, 8,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The vernal pool complex natural community that would likely be affected occurs in the southern reaches of the bypass, south of Putah Creek. There are several relatively large, contiguous areas of vernal pools on the western edge of the bypass in this area. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1B water operations would not adversely affect vernal pool complex habitats, as they have persisted under similar high flows and extended flow periods. There is the potential, however, for some change in plant species composition as a result of longer inundation periods.

CEQA Conclusion: An estimated 0–4 acres of vernal pool complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1B. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of vernal pool complex natural community in the Yolo Bypass would have a less-than-significant impact on the community.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation activities in Plan reserves. These actions are associated with CM1 and CM11 (see Impact BIO-22 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected*

Natural Communities). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect vernal pool habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, AMM30, and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation or damage from recreational activity. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12, AMM30, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Managed Wetland

The conservation components of Alternative 1B would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1B-9). Full implementation of Alternative 1B would also include the following conservation action over the term of the BDCP to benefit the managed wetland natural community.

- Protect and enhance 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3)
- Create 320 acres of managed wetlands consisting of greater sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in Conservation Zones 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events (Objective GSHC1.3, associated with CM10).
- Create two wetland complexes within the SLNWR refuge boundary. Each complex will consist of at least three wetlands totaling 90 acres of greater sandhill crane roosting habitat. One of the wetland complexes may be replaced by 180 acres of cultivated lands that are flooded following harvest for crane roosting and foraging habitat (Objective GSHC1.4, associated with CM10).

In addition to this conservation action, creation of similar habitat values by restoring tidal brackish emergent wetland and tidal freshwater emergent wetland as part of CM4 would further offset the losses of managed wetland. The net effect would be a substantial decrease in the amount of managed wetlands, but an increase in similar habitat value for special-status and common species as the managed wetland is converted to tidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to Impacts

BIO-178 through BIO-183 in the *Shorebirds and Waterfowl* discussion at the end of this section (Section 12.3.3.3) for further consideration of the effects of removing managed wetland natural community.

Table 12-1B-9. Changes in Managed Wetland Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	6	6	18	18	0	0
CM2	24	24	44	44	931–2,612	0
CM4	5,718	13,746	0	0	0	0
CM5	0	0	0	0	0	6
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**5,748**	**13,776**	**60**	**60**	**931–2,612**	**6**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 13,776 acres of managed wetland in the study area. This modification represents approximately 19% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur through the course of the BDCP restoration program, as construction activity and tidal marsh restoration proceeds. Managed wetland protection (8,100 acres) and restoration (500 acres) would take place over the same period, but would not replace the acreage lost. The BDCP beneficial effects analysis for Alternative 4 (BDCP Chapter 5, Section 5.4.9.2) states that at least 8,100 acres of managed wetlands would be protected, of which at least 1,500 acres would be located within the Grizzly Island marsh complex, consistent with the U.S. Fish and Wildlife Service salt marsh harvest mouse recovery plan. Although the primary purpose of the 1,500 acres of protection is to protect and enhance habitat for the salt marsh harvest mouse, it is also expected to benefit the managed wetland natural community and the diversity of species that use it, including migratory waterfowl and the western pond turtle. These same conservation actions would be implemented for Alternative 1B.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 6 acres and temporarily remove 18 acres of managed wetland community. The permanent losses would occur where the new canal would overlay small bands of managed wetland in the vicinity of Lambert Road, at a bridge crossing of the canal at Guard Road just west of Stockton, and on the canal corridor just south of its crossing of the San Joaquin River. The temporary losses would also occur where small patches or stringers of managed wetland would be removed for siphon construction at Beaver Slough, Hog Slough, White Slough, and Railroad Cut. A small area would be temporarily affected by transmission line construction adjacent to Old River near its junction with Victoria Canal (see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities that could permanently or temporarily remove managed wetland, including west side channels modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in managed wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently removed and 44 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13,746 acres of managed wetland community. These losses would be expected to occur primarily in the Suisun Marsh ROA, but could also occur in the Cache Slough and West Delta ROAs (see Figure 12-1). These acres of managed wetland would be converted to natural wetland, including large acreages of tidal brackish emergent wetland and tidal freshwater emergent wetland. These natural wetlands provide comparable or improved habitat for the special-status species that occupy managed wetland. The newly created tidal marsh would not create a barrier or result in fragmentation of managed wetland, as most species are capable of utilizing both communities. An estimated 500 acres of managed wetland would be restored and 8,100 acres would be enhanced and protected through *CM3 Natural Communities Protection and Restoration,* as established by BDCP Objective MWNC1.1. All of the restoration and 4,800 acres of the protection would occur during the first 10 years of Alternative 1B implementation, which would coincide with the timeframe of water conveyance facilities construction and early implementation of CM4. The remaining restoration would be spread over the following 30 years. Managed wetland restoration is expected to include at least 320 acres in CZ 3, CZ 4, CZ 5, and CZ 6 (Figure 12-1) to benefit sandhill crane, as stated in BDCP Objective GSHC1.3. The enhancement and protection would be focused in Suisun Marsh, but could also occur in CZs with existing managed wetland (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and CZ 7).

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would permanently remove 5,748 acres and temporarily remove 60 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Six acres of the permanent loss and 18 acres of the temporary loss would be associated with construction of the water conveyance facilities (CM1). These near-term losses would occur in various locations, but the majority of the near-term loss would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 500 acres (CM10) and protection and enhancement of 4,800 acres (CM3) of managed wetland during the first 10 years of Alternative 1B implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 24 acres of protection would be needed to offset the 24 acres of loss associated with CM1; a total of 5,808 acres of protection would be needed to offset (i.e., mitigate) the 5,808 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 508 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be implemented to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo and Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section (Section 12.3.3.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM*3 *Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*,of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1B, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be an adverse effect when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this adverse effect. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

Late Long-Term Timeframe

At the end of the Plan period, 13,776 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland.

NEPA Effects: Alternative 1B would result in a loss 13,776 acres of managed wetland within the study area; however, it would also protect and enhance 8,100 acres and restore 500 acres of this habitat. In addition, Alternative 1B would restore 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland that support similar ecological functions to those of managed wetland. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion:

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would permanently remove 5,748 acres and temporarily remove 60 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Six acres of the permanent loss and 18 acres of the temporary loss would be associated with construction of the water conveyance facilities (CM1). These losses would occur in various locations, but the majority of the near-term loss would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 and CM10 during the first 10 years of Alternative 1B implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 24 acres of protection would be needed to offset the 24 acres of loss associated with CM1; a total of 5,808 acres of protection would be needed to offset (i.e., mitigate) the 5,808 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 508 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost.

Mitigation measures would also be implemented to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo and Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1B, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be a significant impact when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this significant impact. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the impacts of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Late Long-Term Timeframe

At the end of the Plan period, 13,776 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland. Because these natural wetlands support similar ecological functions to those of managed wetland, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of managed wetland on wildlife management areas and duck clubs scattered up and down the central and southern bypass. CM5 would expose this community to additional inundation as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways in the south Delta.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation of 931-2,612 acres of managed wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 931-acre increase in inundation would be associated with a notch flow of 8,000 cubic feet per second (cfs), and the 2,612-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Based on the theoretical modeling that has been completed to-date, the largest acreages would be associated with the Sacramento Bypass Wildlife Area, the Yolo Bypass Wildlife Area, and private managed wetlands south of Putah Creek. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). With larger flows, the water depths may also increase over Existing Conditions. While the managed wetlands of the Yolo Bypass are conditioned to periodic inundation events, the more frequent and extended inundation periods may make it more difficult to actively manage the areas for maximum food production for certain species (waterfowl primarily) and may alter the plant assemblages in some years. The effects of this periodic inundation on birds and other terrestrial species are discussed later in this chapter. The additional inundation would not be expected to reduce the acreage of managed wetland on a permanent basis. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency, magnitude and duration of inundation of an estimated 6 acres of managed wetland. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The connection of these wetlands to stream flooding events would be beneficial to the ecological function of managed wetlands, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The more frequent flooding would periodically interfere with management activities associated with terrestrial species (primarily waterfowl) and may result in changes in plant composition and management strategies over time.

In summary, 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1B conservation measures (CM2 and CM5).

NEPA Effects: Managed wetland community would not be adversely affected because much of the acreage affected is conditioned to periodic inundation. The more frequent inundation could create management problems associated with certain species, especially waterfowl, and result in changes over time in plant species composition. The total acreage of managed wetland would not be expected to change permanently as a result of the periodic inundation.

CEQA Conclusion: An estimated 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. Managed wetland community would not be significantly impacted because periodic inundation is already experienced by most of the land that would be affected. There could be increased management problems and a long-term shift in plant species composition. The periodic inundation would not be expected to result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the above impact discussion for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and the levees associated with restoration sites (*CM11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during

maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use managed wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow hunting, fishing and hiking in managed wetland reserve areas. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration, CM4 Tidal Natural Communities Restoration,* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in acreage of managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM*10 Nontidal Marsh Restoration and CM4 Tidal Natural Communities Restoration and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1)consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7 (Figure 12-1). The only Alternative 1B conservation component that would potentially affect this natural community is the seasonally inundated floodplain restoration conservation measure (CM5) (see Table 12-1B-10).

Table 12-1B-10. Changes in Other Natural Seasonal Wetland Associated with Alternative 1B (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	0	0	0	0	0	0
CM5	0	0	0	0	0	2
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Based on theoretical footprints for this activity, BDCP conservation measure *CM5 Seasonally Inundated Floodplain Restoration* could expose 2 acres of other natural seasonal wetland community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels, including the channels of Old River and Middle River. Several small patches of other natural seasonal wetland natural community are mapped along these waterways. The exposure of these seasonal wetlands to increased but infrequent episodes of stream flooding would not alter their ecological function or species composition. Their value to special-status and common plants and wildlife in the study area would not be affected. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

NEPA Effects: Alternative 1B conservation actions would not adversely affect other natural seasonal wetland natural community because the small increase in periodic flooding of up to 2 acres would not alter its function or general species makeup.

CEQA Conclusion: An estimated 2 acres of other natural seasonal wetland community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing CM5 under Alternative 1B. This community would not be significantly impacted because a small increase in periodic flooding would not alter its ecological function or species composition. The periodic inundation would not result in a net permanent reduction in the acreage of this community

in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use

in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared with the restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool complex conservation measure includes restoration of 139 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the other natural seasonal wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Grassland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1B would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would result in both permanent and temporary removal of this community (see Table 12-1B-11). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the grassland natural community.

- Protect 8,000 acres of grassland with at least 2,000 acres protected in Conservation Zone 1, at least 1,000 acres protected in Conservation Zone 8, and at least 2,000 acres protected in Conservation Zone 11 (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland and to provide upland habitat adjacent to riparian, tidal, and nontidal natural communities for wildlife foraging and upland refugia (Objective GNC1.2, associated with CM3 and CM8).
- Of the 8,000 acres of grassland protected and at least 2,000 acres of grassland restored, protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide 200 feet of adjacent grasslands beyond the sea level rise accommodation (Objective GNC1.4, associated with CM3 and CM8).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of grassland natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-11. Changes in Grassland Natural Community Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	400	400	358	358	0	0
CM2	388	388	239	239	385–1,277	0
CM4	448	1,122	0	0	0	0
CM5	0	51	0	32	0	514
CM6	Unk.	Unk.	Unk.	Unk.	0	0
CM7	4	410	0	0	0	0
CM11	13	50	0	0	0	0
CM18	35	35	0	0	0	0
	0	0	0	0	0	0
TOTAL IMPACTS	**1,288**	**2,456**	**597**	**629**	**385–1,277**	**514**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would permanently eliminate an estimated 2,456 acres and temporarily remove 629 acres of grassland natural community in the study area. These modifications represent approximately 4% of the 78,047 acres of the community that is mapped in the study area. Approximately 61% (1,885 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 1B implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Grassland protection (2,000 acres), restoration (1,140 acres) and enhancement would be initiated during the same period. By the end of the Plan period, 2,000 acres of this natural community would be restored and 8,000 acres would be protected. The BDCP beneficial effects analysis for grassland for Alternative 4 (BDCP Chapter 5, Section 5.4.11.2) indicates that 8,000 acres of grasslands would be protected in Conservation Zones 1, 2, 4, 5, 7, 8, and 11, and 2,000 acres of grassland would be restored. Grassland protection and restoration would improve connectivity among habitat areas in and adjacent to the Plan Area, improve genetic interchange among native species' populations, and contribute to the long-term conservation of grassland-associated covered species. These same conservation actions would be implemented for Alternative 1B.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would permanently remove 400 acres and temporarily remove 358 acres of grassland natural community. The permanent losses would occur at various locations along the new canal route and at the intake sites along the Sacramento River. The principal losses would occur at intakes 1 and 5; and along the canal east and south of Hood, south of Lambert Road, north of Lost Slough, north of White Slough, and at the San Joaquin River near its junction with Fourteen Mile Slough. These grassland areas are dominated by ruderal herbaceous grasses and forbs. Large permanent losses of annual grassland would also occur at the new forebay site just south of Clifton Court Forebay. The temporary losses would occur at intake sites and at siphon or tunnel work areas where the canal would cross the slough that connects Snodgrass Slough with the south end of Stone Lakes, Lost Slough, Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, San Joaquin River, Railroad Cut, Middle River near its junction with Victoria Canal, and Old River just south of Clifton Court Forebay (see the Terrestrial Biology Mapbook for locations). These losses would take place during the near-term construction period.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction in and around the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Toe Drain/Tule Canal and Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in grassland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 388 acres could be permanently lost and another 239 acres could be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir where a large expanse of grassland is present, along the Toe Drain/Tule Canal, and along the west side channels. These grasslands are composed primarily of upland annual grassland and forbs. Some of this grassland removal along the side channels of the bypass could pose barriers to grassland species moving within the bypass. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 448 acres of grassland in the near-term and inundate or remove 1,122 acres of grassland by the end of the Plan timeframe. The losses would occur in a number of ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Most of this grassland is ruderal and herbaceous vegetation with low habitat value; some of the larger patches of grassland in the Cache Slough ROA are annual grassland with higher values.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration levee construction would permanently remove 51 acres and temporarily remove 32 acres of grassland natural community. The construction-related losses would be considered a permanent removal of the habitats. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). The grassland in this area is primarily composed of narrow bands and small patches of ruderal herbaceous grasses and forbs. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM7 Riparian Natural Community Restoration;* Riparian natural community restoration would occur in a variety of settings in the Plan Area, with an emphasis on improving connectivity of existing riparian areas and stream/river corridors, to benefit the movement and interchange of special-status and common species that use these areas. Large tracts would be restored in concert with floodplain restoration (CM5), while narrower bands would be developed as part of channel margin enhancement (CM6) and tidal marsh restoration (CM4). In the process of expanding woody riparian habitat, existing nonnative grassland would be removed. While specific locations for these restoration activities have not been fully developed, use of theoretical footprints for this activity indicate that up to 410 acres of grassland could be lost through the course of Plan implementation. A majority of this activity would occur in the South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).

- *CM8 Grassland Natural Community Restoration:* The grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZ 1, CZ 8, and CZ 11, as proposed in BDCP Objective GNC1.1 (Figure 12-1), with a goal of improving habitat connectivity and increasing the diversity of grassland species (BDCP Objective GNC1.2). Some of the planned 2,000 acres of restoration would occur around existing populations of giant garter snake in the east Delta and the Yolo Bypass area.

- *CM11 Natural Communities Enhancement and Management:* Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the BDCP. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public's ability to participate in recreational activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known, so the analysis of this activity is programmatic. At the current level of planning, it is assumed that the trail system would be located entirely in grassland habitats and would include up to 50 acres of habitat loss.

- *CM18. Conservation Hatcheries:* The BDCP includes a proposal to design and construct a conservation hatchery to maintain populations of delta smelt and longfin smelt. The location of this facility is not yet firmly established, but for planning purposes it has been assumed that it would be constructed in the vicinity of Rio Vista and would be located in grassland habitat. The grassland in the Rio Vista area includes both California annual grassland and ruderal herbaceous grasses and forbs. The current estimate of the land needed for this facility is 35 acres.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1B would affect the grassland natural community through CM1 construction losses (400 acres permanent and 358 acres temporary), CM2 construction losses (388 acres permanent and 239 acres temporary), CM7 riparian habitat restoration (4 acres permanent), CM11 recreational trail construction (13 acres permanent), and CM18 fish hatchery construction (35 acres permanent). These losses would occur along the eastern bank of the Sacramento River at intake sites, at various locations along the east canal corridor, at currently unspecified sites for hatchery and recreational trail construction and restoration, at the southern forebay, in the northern Yolo Bypass, and along the east and west channels within the Yolo Bypass. Approximately 448 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see BDCP Chapter 3, *Conservation Strategy*). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses later in this chapter. The combination of restoring 1,140 acres (CM8) and protecting 2,000 acres (CM3) of grassland natural community during the first 10 years of Alternative 1B implementation, and the commitment to restore temporarily affected grassland (597 acres) to its pre-project condition within one year of completing construction as required *by AMM10 Restoration of Temporarily Affected Natural Communities* would not completely offset this near-term loss and avoid any loss in the availability of this habitat for special-status species. Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,770 acres of protection would be needed to offset (i.e., mitigate) the 1,885 acres of loss. The restoration and protection measures contained in Alternative 1B would fall short of complete mitigation by 33 acres in the near-term. Because grassland is not considered a special-status natural community, this effect would not be adverse. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1B as a whole would result in 4% losses of grassland natural community in the study area. These losses (2,456 acres of permanent and 629 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities at various tidal restoration sites throughout the study area.

NEPA Effects: By the end of the Plan timeframe, a total of 2,000 acres of this natural community would be restored (CM8) and 8,000 acres would be protected (CM3). The restoration would occur primarily in CZ 1, CZ 8, and CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity. The 2,000 acres of restoration associated with CM8, and the restoration of temporarily affected grassland required by AMM10 (629 acres for Alternative 1B) would not totally replace the grassland acres lost through the Plan timeframe (3,085 acres). There would be a permanent loss of 456 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 1B would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1B would result in the loss of approximately 1,885 acres of grassland natural community due to construction of the water conveyance facilities (CM1), fish passage improvements (CM2), inundation during tidal marsh restoration (CM4), riparian habitat restoration (CM7), recreational trail construction (CM11), and fish hatchery construction (CM18). These losses would occur at Sacramento River intake sites, at various locations along the east canal corridor, at the southern forebay, in the northern Yolo Bypass, at as yet undetermined recreational trail and fish hatchery construction sites, at riparian habitat restoration sites, along the east and west channels within the Yolo Bypass, and at inundation sites at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. These losses would not be totally offset by planned restoration of 1,140 acres and protection of 2,000 acres of grassland natural community scheduled for the first 10 years of Alternative 1B implementation, and the restoration of temporarily affected grassland (597 acres under Alternative 1B) as dictated by AMM10. Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,770 acres of protection would be needed to offset (i.e., mitigate) the 1,885 acres of loss. The restoration and protection would fall 33 acres short in the near-term. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting near-term restoration and protection activities and AMMs, and because grassland is not a special-status natural community, the impacts would be less-than-significant.

Late Long-Term Timeframe

At the end of the Plan period, 3,085 acres of grassland natural community would be permanently or temporarily removed by conservation actions, 2,000 acres would be restored and 8,000 acres would be protected. Temporarily affected areas would also be restored (629 acres for Alternative 1B). While there would be a net permanent reduction in the acreage of this natural community within the study area (total loss of 456 acres), there would be an increase in the value of grassland for special-status and common species in the study area through the combination of conservation actions (CM3 and CM8) and avoidance and minimization measures (AMM1, AMM2, AMM6, AMM7, and AMM10). Therefore, Alternative 1B would have a less-than-significant impact on this natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Two Alternative 1B conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of grassland natural community at scattered locations, while CM5 would expose this community to additional inundation as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement:* Operation of the Yolo Bypass under Alternative 1B would result in an increase in the frequency, magnitude and duration of inundation of 385–1,277 acres of grassland natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly-constructed notch in the Fremont Weir. The 385-acre increase in inundation would occur at the 1,000 cfs flow regime, while the 1,277-acre increase would occur at the 4,000 cfs flow regime. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The grassland community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass, in stringers along the internal waterways of the bypass and in larger patches in the lower bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect grassland habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in grass species composition as a result of longer inundation periods. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration would result in an increase in the frequency and duration of inundation of 514 acres of grassland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 3-1). The increase in periodic stream flooding events would not adversely affect the habitat values and functions of grassland natural community.

In summary, 899–1,790 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. The grassland community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would not constitute an adverse effect.

CEQA Conclusion: An estimated 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1B. The grassland natural community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would have a less-than-significant impact on the community.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1B are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-30 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require

removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1B intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM8 Grassland Natural Community Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1B would not result in a net permanent reduction in the grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1B would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM8 Grassland Natural Community Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community includes approximately 20 acres of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1b). While the inland dune scrub natural community is within the BDCP Plan Area, none of the Alternative 1B conservation measures or covered actions are expected to affect this community.

Cultivated Lands

Cultivated lands is the major land-cover type in the study area (487,106 acres, see Table 12-1). The Delta, the Yolo Bypass and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 list special-status wildlife species supported by cultivated lands.

The effects of Alternative 1B on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species in this chapter also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses below, there is no separate analysis of this land cover type presented here. Table 14-8 in Chapter 14, *Agricultural Resources*, provides a comparison of important farmland losses that would result from construction of CM1 water conveyance facilities for each alternative, and Table 14A-1 in Appendix 14A, *Individual Crop Effects as a Result of BDCP Water Conveyance Facility Construction,* provides a similar comparison for losses of individual crops. Table 12-ES-1 in this chapter's Summary of Effects identifies the total cultivated lands loss for all project alternatives. For Alternative 1B, the total temporary and permanent loss is estimated to be 72,778 acres. The majority of the permanent loss would be associated with habitat restoration activities, including Yolo Bypass fisheries enhancement (CM2; 629 acres), tidal marsh restoration (CM4; 39,565 acres), floodplain restoration (CM5; 2,087 acres), riparian natural community restoration (CM7; 960 acres), grassland restoration (CM8; 2,000 acres) and nontidal marsh restoration (CM10; 1,950 acres). Construction of the eastern canal alignment water conveyance facilities (CM1) would permanently remove 7,451 acres of cultivated land.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized here as developed lands. Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities. Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap provide habitat for giant garter snake. There are approximately 90,660 acres of developed lands in the study area.

As with cultivated lands, no effort has been made to analyze the effects of BDCP covered actions on this land cover type. It is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants. These areas do not include topographic depressions that are characteristic of vernal pool crustacean habitat and, thus, are considered to have a lower value for the species.

Construction and restoration associated with Alternative 1B conservation measures would result in permanent losses (see Table 12-1B-12) and indirect conversions of vernal pool crustacean modeled habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of the BDCP would also include the following conservation actions over the term of the BDCP to benefit vernal pool crustaceans (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (Objective VPNC1.3).
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4).
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1).
- Protect one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-12. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1[c]	High-value	1	1	0	0	NA	NA
	Low-value	3	3	0	0	NA	NA
Total Impacts CM1		**4**	**4**	**0**	**0**	**NA**	**NA**
CM2–CM18[c]	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**205**	**376**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 1B conservation measures would result in the direct, permanent loss of up to 376 acres of modeled vernal pool crustacean habitat from conveyance facility construction (CM1) and tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrological changes of an additional 149 acres of vernal pool crustacean habitat (91 acres of high-value habitat and 58 acres of low-value habitat) from conveyance construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute and a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 1B would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool fairy shrimp (270 acres), and vernal pool tadpole shrimp (270 acres) from the hypothetical tidal restoration (CM4) footprints in CZ 11. *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the covered vernal pool crustaceans. As specified in *AMM12 Vernal Pool Crustaceans* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. *AMM12* would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of 4 acres of vernal pool crustacean habitat, composed of 1 acre of high-value habitat and 3 acres of low-value vernal pool crustacean habitat. These impacts would occur from the construction of a new bridge on Hood Franklin Road where it crosses a large canal just before the town of Hood and from construction around Clifton Court Forebay. The bridge expansion area has a record for California linderiella and there are records for vernal pool fairy shrimp and vernal pool tadpole shrimp just to the east on this property. There are records of vernal pool fairy shrimp adjacent to the impact areas around Clifton Court forebay. In addition, 14 acres of vernal pool crustacean habitat (2 acres of high-value habitat and 12 acres of low-value habitat) could be indirectly affected by the construction around Clifton Court Forebay and the construction of the aforementioned bridge.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool crustacean habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool crustaceans as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Game 2012). Helm (1998) notes that many vernal pool crustaceans can occur in degraded vernal pool habitats and artificial habitats. In CZ 2 and CZ 4, there are several records of covered vernal pool crustaceans occurring outside of modeled habitat in areas that appear to be road side ditches. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool crustaceans and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool crustacean habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool crustacean habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. The hypothetical restoration footprints overlap with a CNDDB record for vernal pool fairy shrimp near the current edge of Suisun Marsh. Tidal natural community restoration under Alternative 1B would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool tadpole shrimp (270 acres), and vernal pool fairy shrimp (270 acres). *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool crustaceans (Table 12-1B-12). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values over the term of the BDCP. Human presence for recreation activities could result in the injury, mortality of, and degreation of habitat for vernal pool crustaceans through trampling pool edges, increased turbidity, unauthorized collection, and introduction of trash. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. NEPA and CEQA impact conclusions are also included. Table 12-1B-13 was prepared to further analyze BDCP effects on vernal pool crustaceans using wetted acres of vernal pools in order to compare to the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes Pools would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex, 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-1B-13. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 1B (acres)[a]

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 1B Impact[b]	CM1	0.6	0.6	2.1	2.1
	CM4[c]	30.2	55.8	11.0	20.4
Total		**30.8**	**56.4**	**13.1**	**22.5**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1B-12 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and will likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool crustacean habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1B-12 above lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans. As seen in Table 12-1B-13, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1B-13, Alternative 1B would not meet the Plan's near-term biological goals and objectives for direct loss and indirect conversion unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.6 wetted acre of vernal pool crustacean habitat (or 4 acres of vernal pool complex) should be restored and 5.4 wetted acres of vernal pool crustacean habitat (or 36 acres of vernal pool complex) should be protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1B-13, the effects of tidal restoration in the near-term could not exceed 4.4 wetted acres direct and 7.9 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1B-13, the effects of CM1 alone would be well within the near-term limits, but overall Alternative 1B would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

NEPA Effects: The near-term loss of vernal pool crustacean habitat under Alternative 1B would not be adverse under NEPA because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the modification of vernal pool crustacean habitat and potential mortality of a special-status species resulting from Alternative 1B in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the period of construction. Considering these commitments, losses and conversion of vernal pool crustacean habitat and potential mortality under Alternative 1B would not be an adverse effect on vernal pool crustaceans.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant. Table 12-1B-12 above lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans. As seen in Table 12-1B-13, the impacts of CM1 alone would be well within the near-term limits. As seen in Table 12-1B-13, Alternative 1B would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.6 wetted acre of vernal pool crustacean habitat (or 4 acres of vernal pool complex) should be restored and 5.4 wetted acres of vernal pool crustacean habitat (or 36 acres of vernal pool complex) should be protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1B-13, the near-term effects of tidal restoration could not exceed 4.4 wetted acres direct and 7.9 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The above natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and the biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 1B on vernal pool crustaceans would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1B-13, the effects of CM1 alone would be well within the near-term limits, but overall Alternative 1B would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by the following the other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

Alternative 1B would result in substantial habitat modifications to vernal pool crustacean habitat in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the construction phase. Considering these commitments, Alternative 1B over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 1B would have a less-than-significant impact on vernal pool crustaceans.

Impact BIO-33: Indirect Effects of Plan Implementation on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of Alternative 1B implementation would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the construction phase. The indirect impacts of Alternative 1B would be less-than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled vernal pool crustacean habitat (Table 12-1B-12). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration.*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect vernal pool crustaceans occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would not be adverse under NEPA.

CEQA Conclusion: Alternative 1B would periodically inundate no more than 4 acres of vernal pool crustacean habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of vernal pool crustacean habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus result in less-than-significant impacts on the species.

Valley Elderberry Longhorn Beetle

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation measures, on the valley elderberry longhorn beetle. That habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (channels and grasslands within 200 feet of channels). Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-1B-14. The majority of the losses would take place over an extended period of time as the restoration conservation measures are being implemented. In addition, an estimated 23 elderberry shrubs could be impacted by the Alternative 1B conveyance alignment (CM1). Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit valley elderberry longhorn beetle (BDCP Chapter 3, *Conservation Strategy*).

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines for the species (Objective VELB1.1).
- Site elderberry longhorn beetle habitat restoration adjacent to occupied habitat (Objective VELB1.2).
- Restore 5,000 acres of valley/foothill riparian (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of valley/foothill riparian (Objective VFRNC1.2, associated with CM3).
- Maintain or increase the abundance and distribution of rare or uncommon vegetation alliances, such as *Sambuca nigra* (blue elderberry stands) alliance (Objective VFRNC3.1, associated with CM7 and CM11).

As explained below, with the restoration or protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-14. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation		Permanent		Temporary		Periodic[d]	
Measure[b]	Habitat Type	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	51	51	39	39	NA	NA
	Non-riparian	158	158	88	88	NA	NA
Total Impacts CM1		**209**	**209**	**127**	**127**	**NA**	**NA**
CM2–CM18	Riparian	381	678	76	111	44–80	266
	Non-riparian	142	311	94	108	103–244	287
Total Impacts CM2–CM18		**523**	**989**	**170**	**219**	**161–325**	**553**
TOTAL IMPACTS		**732**	**1,198**	**297**	**346**	**161–325**	**553**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 1B conservation measures would result in the permanent and temporary loss combined of up to 1,544 acres of modeled valley elderberry longhorn beetle habitat (879 acres of riparian habitat and 665 acres of nonriparian habitat), and an estimated 23 elderberry shrubs, which represent potential habitat for the species (Table 12-1B-14). Due to the limitation of the habitat suitability model, all of these effects are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Timely implementation of the near-term habitat protection and restoration contained in the Plan and implementation of AMMs committed to in the Plan would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent and temporary combined loss of approximately 336 acres of modeled valley elderberry longhorn beetle habitat, composed of 90 acres of riparian habitat and 246 acres of nonriparian habitat (Table 12-1B-14). In addition, an estimated 23 shrubs could be potentially removed as a result of conveyance facility construction. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 127 acres of modeled valley elderberry longhorn beetle habitat (39 acres riparian and 88 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, temporary access roads, and staging areas.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 295 acres of modeled valley elderberry longhorn beetle habitat, composed of 159 acres of riparian habitat and 136 acres of nonriparian habitat. Approximately 125 acres of permanent impacts (83 acres of riparian and 41 acres of nonriparian) would mostly occur at the north end of the Yolo Bypass from Fremont Weir improvements. The 170 acres of temporary impacts (76 acres of riparian and 94 acres of nonriparian) would mostly be from work on the Freemont Weir, the Sacramento Weir, and levees along the Bypass. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee modification, and removal of riprap and other protections from channel banks.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 813 acres of modeled valley elderberry longhorn beetle habitat, composed of 552 acres of riparian and 260 acres of nonriparian habitat. The majority of these impacts would be associated with tidal restoration in the Delta and only 42 acres of these impacts (all nonriparian) would be from tidal restoration in Suisun Marsh. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 101 acres of valley elderberry longhorn beetle habitat, composed of 78 acres of riparian and 23 acres of nonriparian. Approximately half of these impacts (52 acres) would be permanent impacts from levee construction and the other half (49 acres) would be temporary impacts associated with the levee construction. There is one CNDDB record of valley elderberry longhorn beetle occurring in CZ 7 just west of Middle River on Union Island. This record and other elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee removal and modification, and removal of riprap and other protections from channel banks.
- *CM11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of BDCP protected habitats for covered species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs discussed below.
- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could potentially affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs described below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1B would result in permanent and temporary impacts on 1,029 acres of modeled habitat (547 acres of riparian and 482 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 90 acres of riparian and 246 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 547 acres (84%) of impacts on riparian habitat. Based on limited DWR survey data of the Conveyance Planning Area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental*

Data Report), an estimated 23 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified as habitat for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 90 acres of the riparian habitat should be restored/created and 90 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB1.1 and 1.2, which call for implementing the USFWS (1999) conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of CM7 *Riparian Natural Community Restoration*. CM7 *Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals and the additional species specific measures within CM7 satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigating the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* AMM10 *Restoration of Temporarily Affected Natural Communities*, and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 1,544 acres of modeled valley elderberry longhorn beetle habitat (879 acres of riparian habitat and 665 acres of nonriparian habitat) during the term of the Plan (approximately 5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. Other factors relevant to effects on valley elderberry longhorn beetle include are listed below.

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat during the near-term evaluation period because most of the affected riparian vegetation would be removed during the near-term timeframe, while large quantities of riparian habitat would not be restored until the early and late long-term timeframes. Effects on valley elderberry longhorn beetle of this temporal loss of riparian vegetation are expected to be minimal because much of the riparian habitat in the Plan Area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation would be moved to conservation areas in the Plan Area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the Plan Area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the conservation measures or other covered activities that would result in temporary effects on natural communities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

NEPA Effects: The near-term loss of valley elderberry longhorn beetle habitat under Alternative 1B would not be adverse because the BDCP has committed to restoring and protecting an acreage that exceeds the typical mitigation ratios described above, in addition to avoiding impacts on shrubs and transplanting those that can't be avoided. In the absence of other conservation actions, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 1B in the late long-term would represent an adverse effect. However, with habitat protection and restoration associated with CM7, guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the construction period, the effects of Alternative 1B as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 1B would result in permanent and temporary impacts on 1,029 acres of modeled habitat (547 acres of riparian and 482 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These impacts would result from the construction of the water conveyance facilities (CM1, 90 acres of riparian and 246 acres of nonriparian), and implementation of other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 547 acres (84%) of impacts on riparian habitat. Based on limited DWR survey data of the Conveyance Planning Area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), an estimated 23 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 90 acres of the riparian habitat should be restored/created and 90 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB1.1 and 1.2, which call for implementing the USFWS conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999). These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. CM7 specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* AMM10 *Restoration of Temporarily Affected Natural Communities*, and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs, are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 1,544 acres of modeled valley elderberry longhorn beetle habitat (879 acres of riparian habitat and 665 acres of nonriparian habitat) during the term of the Plan (approximately 5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. The BDCP also includes a number of AMMs (AMM1–AMM6, AMM10, and AMM15) directed at minimizing or avoiding potential impacts on valley elderberry longhorn beetle. The large acreages of conservation would adequately compensate for the modeled habitats lost to construction and restoration activities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1B as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on valley elderberry longhorn beetle over the term of the BDCP. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis (see Section 12.3.2.3 for a discussion on the methods used to make this estimate) estimates that approximately 15 shrubs could be indirectly affected by conveyance facilities construction (CM1). Restoration activities could result in excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15, which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 1B conservation actions would not have an adverse effect on valley elderberry longhorn beetle.

***CEQA Conclusion*:** Ground-disturbing activities, stockpiling of soils, and the potential release of dust and hazardous substances would accompany construction of the water conveyance facilities. An estimated 15 shrubs could be indirectly affected by conveyance facilities construction (CM1). In addition, ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks could indirectly affected elderberry shrubs that occur within 100 feet of these restoration activities. With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 1B construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse indirect effects on valley elderberry longhorn beetle in that the Plan would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Indirect effects of Alternative 1B implementation would not have a significant impact on valley elderberry longhorn beetle.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 161 to 325 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1B-14).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 553 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1B-14).

It is unknown at this time how much of the modeled habitat that would be inundated as a result of CM2 and CM5 actually contains elderberry shrubs. Elderberry shrubs have been found to be intolerant of long periods of inundation and there is evidence that they die very quickly after even short periods of flooding (River Partners 2008). During monitoring of a restoration project at the San Joaquin River National Wildlife Refuge, River Partners found that nearly all (99% to 100%) of the 4-year-old elderberry shrubs in restoration plots died after 15–17 weeks of inundation, and River Partners noted in general that the shrubs died very quickly after even short periods of flooding (River Partners 2008). Talley et al (2006) in their report assisting the USFWS 5-year review of the species, note that elderberry shrubs respond negatively to saturated soil conditions and that they can only tolerate temporary root crown inundation. Therefore, in the areas that would be periodically inundated by the implementation of CM2 it is likely that there are few, if any, mature shrubs in these areas because under current conditions they would be inundated in about 50% of all years for approximately 7 weeks. The areas affected by CM5 are not currently inundated and thus elderberry shrubs could present in these areas.

The periodic effects on modeled habitat for valley elderberry longhorn beetle associated with implementing Alternative 1B could adversely affect valley elderberry longhorn beetle habitat (elderberry shrubs) and make modeled habitat there unsuitable for future elderberry establishment. Based on the information presented above, the current conditions in those areas that would be periodically inundated in Yolo Bypass (CM2) are not likely very suitable for elderberry shrubs and thus CM2 would likely have minimal effects, if any, on the species. The modeled habitat that would be periodically inundated from the implementation of CM5 could result in adverse effects on valley elderberry longhorn beetle.

NEPA Effects: Periodic effects of the inundation of valley elderberry longhorn beetle habitat as a result of implementing Alternative 1B conservation actions would not be adverse when taking into consideration CM7 habitat protection and restoration. This habitat protection and restoration would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the period when periodic effects would occur.

CEQA Conclusion: Alternative 1B (CM2 and CM5) would have periodic impacts on modeled valley elderberry longhorn beetle habitat. The periodic inundation of between 161 and 325 acres (CM2) and 553 acres (CM5) of modeled habitat could result in the death of elderberry shrubs that may occur there and thus potentially impact valley elderberry longhorn beetle. The Plan includes the restoration of 5,000 acres of riparian habitat and the protection of 750 acres riparian habitat (CM7) would include areas for elderberry restoration and protection. The BDCP also includes AMM1–AMM6, AMM10, and AMM15, which would minimize and avoid impacts on valley elderberry longhorn beetle prior to Yolo Bypass fisheries enhancement and floodplain restoration activities. AMM15, which includes a measure for following the USFWS (U.S. Fish and Wildlife Service 1999a) conservation guidelines for valley elderberry longhorn beetle, would be used to identify shrubs for transplanting to conservation areas that otherwise could be adversely affected by periodic inundation in Yolo Bypass and floodplain restoration areas. These conservation actions would compensate for the periodic impacts on valley elderberry longhorn beetle.

Considering these protection and restoration provisions and avoidance and minimization measures, implementation of Alternative 1B as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, periodic effects of inundation resulting from Alternative 1B would have a less-than-significant impact on valley elderberry longhorn beetle.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on nonlisted vernal pool invertebrates that are not covered by the Plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants. These areas do not include topographic depressions that are characteristic of vernal pools and, thus, are considered to have a lower value for the species.

Construction and restoration associated with Alternative 1B conservation measures would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-1B-15 and indirect conversion of vernal pool habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP that would benefit nonlisted vernal pool invertebrates (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (ObjectiveVPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (ObjectiveVPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)

As explained below, with the restoration or protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would not be adverse for NEPA purposes and would be less-than significant for CEQA purposes.

Table 12-1B-15 Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	High-value	1	1	0	0	NA	NA
	Low-value	3	3	0	0	NA	NA
Total Impacts CM1		**4**	**4**	**0**	**0**	**NA**	**NA**
CM2–CM18	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**205**	**376**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. Yolo periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 1B conservation measures would result in the direct permanent loss of up to 376 acres of vernal pool habitat from conveyance facility construction (CM1) and tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 149 acres of vernal pool habitat (91 high-value habitat and 58 acres of low-value habitat) from conveyance construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pool habitat to constitute a possible conversion of the habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the vernal pools. As specified in the BDCP, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool habitat are permanently lost. *AMM12 Vernal Pool Crustaceans* would ensure that no more than 20 wetted acres of vernal pool habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is comprised of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of 4 acres of vernal pool habitat, composed of 1 acre of high-value habitat and 3 acres of low-value vernal pool habitat. These impacts would occur from the construction of a new bridge on Hood Franklin Road where it crosses a large canal just before the town of Hood and from construction around Clifton Court Forebay. In addition, 14 acres of vernal pool habitat (2 acres of high-value habitat and 12 acres of low-value habitat) could be indirectly affected by the construction around Clifton Court Forebay and the construction of the aforementioned bridge.

- *CM4 Tidal Natural Communities Restoration:* Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown but from a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for nonlisted vernal pool invertebrates. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for nonlisted vernal pool invertebrates and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied nonlisted vernal pool invertebrate habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. No records of nonlisted vernal pool invertebrates would be directly impacted by CM4.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit nonlisted vernal pool invertebrates (Table 12-1B-15). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. NEPA and CEQA impact conclusions are also included. Table 12-1B-16 was prepared to further analyze BDCP effects on nonlisted vernal pool invertebrates using wetted acres of vernal pools in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that vernal pool and degraded vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-1B-16. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 1B (acres)[a]

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 1B Impact[b]	CM1	0.6	0.6	2.1	2.1
	CM4[c]	30.2	55.8	11.0	20.4
Total		**30.8**	**56.4**	**13.1**	**22.5**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1B-15 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and will likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1B-15 above lists the effects on habitat for nonlisted vernal pool invertebrates that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pool. As seen in Table 12-1B-16, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1B-16, Alternative 1B would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.6 wetted acre of nonlisted vernal pool species habitat (or 4 acres of vernal pool complex) should be restored and 5.4 wetted acres of nonlisted vernal pool species habitat (or 36 acres of vernal pool complex) should be protected to mitigate the CM1 direct and indirect effects on nonlisted vernal pool invertebrate habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1B-16, the near-term effects of tidal restoration in the near-term could not exceed 4.4 wetted acres direct and 7.9 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects nonlisted vernal pool invertebrates.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1B-16, the effects of CM1 alone would be well within the near-term limits, but overall Alternative 1B would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).

NEPA Effects: The near-term loss of vernal pool habitat under Alternative 1B would not be adverse because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the potential modification of vernal pool habitat and potential mortality of special-status species resulting from Alternative 1B in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, losses and conversions of nonlisted vernal pool invertebrates habitat and potential mortality under Alternative 1B would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction be less than significant. Table 12-1B-15 lists the impacts on vernal pool habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on nonlisted vernal pool invertebrate habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools. As seen in Table 12-1B-16, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-1B-16, Alternative 1B would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 0.6 wetted acre of nonlisted vernal pool species habitat (or 4 acres of vernal pool complex) should be restored and 5.4 wetted acres of nonlisted vernal pool species habitat (or 36 acres of vernal pool complex) should be protected to mitigate the CM1 direct and indirect effects on nonlisted vernal pool invertebrate habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1B-16, the near-term effects of tidal restoration could not exceed 4.4 wetted acres direct and 7.9 wetted acres indirect. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5 wetted acres (33 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools will be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools will be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The above natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and the biological goals and objectives, are more than sufficient to support the conclusion that the near-term impacts of Alternative 1B on nonlisted vernal pool invertebrates would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1B-16, the effects of CM1 alone would be well within the near-term limits, but overall Alternative 1B would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to a late long-term goal of protecting 600 acres of vernal pool complex in Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).

Alternative 1B would result in substantial habitat modifications to vernal pool habitat in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by goals and objectives and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period of construction, Alternative 1B over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 1B would have a less-than-significant impact on nonlisted vernal pool invertebrates.

Impact BIO-39: Indirect Effects of Plan Implementation on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6 AMM10, and AMM12 which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Nonlisted vernal pool invertebrates and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6 and AMM10 which would be in effect throughout the term of the Plan. The indirect effects of Plan implementation under Alternative 1B would not be adverse.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6 and AMM10, which would be in effect throughout the Plan's construction phase. These indirect effects of Alternative 1B would have a less-than significant impact on nonlisted vernal pool invertebrates.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled habitat for nonlisted vernal pool invertebrates (Table 12-1B-15). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration.*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect nonlisted vernal pool invertebrates occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would not be adverse.

CEQA Conclusion: Alternative 1B would periodically inundate at most 4 acres of nonlisted vernal pool invertebrates' habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of nonlisted vernal pool invertebrates' habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations will not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus result in less-than-significant impacts on the species.

Sacramento and Antioch Dunes Anthicid Beetles

Potential habitat for Sacramento and Antioch Dunes anthicid beetles in the study area consists of the inland dune scrub habitat at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 1B would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance facilities construction would not affect inland dune scrub habitat at Antioch Dunes NWR. No dredge spoil areas that could potentially be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 1B water intake facilities on Google Earth imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of BDCP restoration based conservation measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the Plan Area is at Antioch Dunes, which would not be impacted by the Alternative 1B conservation measures. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of BDCP restoration actions, and other covered activities could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the Plan Area; however the extent of these habitats in the Plan Area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy dredge piles on Delta islands.

Over the term of the BDCP, Alternative 1B would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 1B objectives would generally increase opportunities for the formation of sandbars in the Plan Area.

- Restore 10,000 acres of seasonally inundated floodplain (Objective L2.11, associated with CM5).
- Enhance 20 miles of channel margin habitat (Objective L2.12, associated with CM6).
- Restore 5,000 acres of riparian habitat, with at least 3,000 acres occurring on restored seasonally inundated floodplain. (VFRNC1.1, associated with CM7).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins and in floodplains, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins and floodplains would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-17. Changes in Sacramento Anthicid Beetle and Antioch Dunes Anthicid Beetle Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	0	0	0	0	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 1B conservation measures could potentially affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur along to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A 2012 review of Google Earth imagery of the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery of the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Conservation measures that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal natural communities restoration (CM4), seasonally inundated floodplain restoration (CM5), and channel margin enhancement (CM6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could potentially impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The West Delta ROA has been identified in the BDCP (BDCP Chapter 3, *Conservation Strategy*, Section 3.4.4) as providing opportunities for creating subtidal aquatic and tidal marsh habitats. The methods and techniques identified in BDCP Chapter 3, Section 3.4.4.3.3 that may be used for tidal restoration include the recontouring of lands so that they have elevations suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.

- *CM5 Seasonally Inundated Floodplain Restoration*: Seasonally inundated floodplain restoration could potentially impact areas with sandbars that were identified in a review of aerial photographs. The sandbars identified along the San Joaquin River and Paradise Cut are within the conceptual corridors (Corridors 1a, 1b, 2a, and 4) identified in Figure 3.4-20 of the BDCP. There are four CNDDB records for Sacramento anthicid beetle in the conceptual corridor along the San Joaquin River (California Department of Fish and Wildlife 2013). Floodplain restoration actions in these conceptual corridors could impact potential habitat for both these species and occupied habitat of Sacramento anthicid beetle.

- *CM6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 20 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The BDCP could result in substantial affects to Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which is being considered for tidal restoration (CM4), or within three of the conceptual corridors being considered for floodplain restoration (CM5). Furthermore, all seven of the records for Sacramento anthicid beetle within the study area fall within areas being considered for restoration (CM4 and CM5), which represent over half of the extant records for this species range wide (7 of 13), and the only extant record for Antioch Dunes anthicid beetle, which represent one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected by restoration if these areas are chosen as restoration projects. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. Alternative 1B conservation measures CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. These measures would improve shoreline conditions by creating benches along levees (CM6), creating shallow margin and floodplain habitat (CM5), and increasing shoreline vegetation (CM7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form. Other factors relevant to effects on Sacramento and Antioch Dunes anthicid beetles are listed below.

- The actual extent of suitable and occupied habitat for these species in the plan is unknown.

- The sandbar habitat occupied by Sacramento anthicid beetle along the San Joaquin River would likely not be directly impacted where floodplain restoration occurs because the physical disturbance would be to adjacent levees and agricultural areas. Though these actions would change hydrologic conditions that could overtime remove the existing sandbars, the expanded floodplain would create conditions suitable for the formation of new and possibly larger sandbars.
- Floodplain restoration would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

NEPA Effects: In the absence of other conservation actions, the potential effects on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 1B would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with implementation of restoration associated with CM5, CM6, and CM7, which would be phased throughout the construction phase, the effects of Alternative 1B as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion: Alternative 1B would impact Sacramento and Antioch Dunes anthicid beetles habitat and could potentially impact seven occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. BDCP conservation components, particularly conservation measures CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. Floodplain restoration (CM5) would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

Considering that floodplain (CM5), channel margin enhancement (CM6), and riparian restoration (CM7) would contribute to the replacement of and possible expansion of sandbar habitat in the Delta and be phased throughout the time period when the impacts would be occurring, the implementation of Alternative 1B as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than significant impact on Sacramento and Antioch Dunes anthicid beetles.

Delta Green Ground Beetle

Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1B would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 1B could potentially affect delta green ground beetle through the protection of grasslands and vernal pool complex (CM3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions and recreational trail construction (CM11) in these areas. In addition, tidal natural communities restoration (CM4) and vernal pool and alkali seasonal wetland complex restoration (CM9) could result in potential impacts on delta green ground beetle and its habitat. Full implementation of Alternative 1B would likely result in beneficial effects on delta green ground beetle through the following conservation actions.

- Protect 2,000 acres of grassland in CZ 1 (Objective GNC1.1, associated with CM3).
- Protect 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1, associated with CM3).
- Restore up to 67 acres of vernal pool complex in CZs 1, 8, and/or 11 (Objective VPNC1.2, associated with CM9).

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1B-18. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	0	0	0	0	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 1B conservation measures could result in the conversion of habitat for and direct mortality of delta green ground beetle. Conservation measures that could affect delta green ground beetle are tidal natural communities habitat restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and habitat enhancement and management activities (CM11) in CZ 1. CZ 1 is the only portion of the Plan Area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; U.S. Fish and Wildlife Service 2009a). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *CM4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. CM4 identifies at least 5,000 acres of freshwater tidal natural communities restoration in the Cache Slough ROA and Lindsey Slough and Calhoun Cut have been identified as areas suitable for restoration. Lindsey Slough is just east of Jepson Prairie, and Calhoun Cut, which is off of Lindsey Slough (see Figure 12-1), goes into the general Jepson Prairie area and is adjacent to areas of potential habitat for delta green ground beetle. The tidal restoration methods and techniques identified in CM4 (see BDCP Chapter 3, Section 3.4.4.3.3) includes excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affects delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species. No CNDDB records for delta green ground beetle are intersected by the hypothetical tidal restoration footprints being used by the BDCP.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle. However, if these activities do take place in suitable habitat, then disturbances could result in direct mortality of the species. Still, restoration ultimately would expand habitat available to the species.

- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 1 and a portion of the 600 acres of protection and possibly some of the up to 10 wetted acres of vernal pool restoration could also occur in CZ 1. Potential effects from CM11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of CM11 would result in impacts on 15.5 acres of grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The protection of 2,000 acres of grassland in CZ 1 (CM3) and the protection of 600 acres of vernal pool complex and up 10 wetted acres of vernal pool complex restoration, some of which could occur in CZ 1 (CM3 and CM9), could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle.The management of these grasslands and vernal pool complexes according to *CM11 Natural Communities Enhancement and Management* and the construction of recreational trails in CZ 1 has a potential to affect this species. *AMM37 Recreation* would ensure that new trails in vernal pool complexes are sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools would not be adversely affected. Direct mortality and/or the affects on delta green ground beetle habitat would be an adverse effect under NEPA. Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would be available to reduce this effect.

***CEQA Conclusion*:** The implementation of grassland and vernal pool complex protection (CM3), tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), recreational trail construction, and subsequent enhancement and management actions (CM11) could potentially impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possibly Lindsey Slough could affect habitat and result in direct mortality of the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from CM11 could include direct mortality of larvae and adults resulting from the implementation of recreation trail construction in 15.5 acres of grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes are sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and, therefore, could result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce these potential impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areas in the area of Jepson Prairie, BDCP proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.
- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing covered activities in these areas will be avoided, which for the Plan Area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing covered activities will occur in areas identified as occupied by delta green ground beetle.

- Based on the results of the habitat evaluations and surveys, site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

Suitable habitats for callippe silverspot butterfly are typically in areas influenced by coastal fog with hilltops that support the specie's host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldenaster, coast buckwheat, mourning bride, and California buckeye. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1B would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *CM3 Natural Communities Protection and Restoration*, the subsequent implementation of *CM11 Natural Communities Enhancement and Management* could potentially affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the Plan Area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Though CZ 11 has been identified as potential area for grassland restoration in *CM8 Grassland Natural Community Restoration,* the primary goal there is to restore small patches of grassland to connect to Jepson Prairie and/or the restoration of upland grasses adjacent to tidal brackish emergent wetland in Suisun Marsh, both of which would not be areas suitable for callippe silverspot butterfly. The full implementation of Alternative 1B would protect up to 2,000 acres of grassland in CZ 11 (Objective GNC1.1, associated with CM3), some of which may contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1B-19. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	0	0	0	0	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 1B conservation measures could result in the conversion of habitat and/or direct mortality to Callippe silverspot butterfly. Only one conservation measure was identified as potentially affecting callippe silverspot butterfly, *CM11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *CM3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

CM11 Natural Communities Enhancement and Management: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of 2,000 acres of grassland within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. The management of these grasslands according to CM11 has potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *CM3 Natural Communities Protection and Restoration*, then the subsequent management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has the potential to affect this species. Potential impacts from CM11 could include the loss of larval host and nectar sources and direct mortality of larvae and adults resulting from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control that may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, which could result in direct and indirect effects on larval host plants and nectar plants. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would, therefore, result in a significant impact on the species. However, over the term of the BDCP, callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and reduce the potential impact to a less-than-significant level.

Mitigation Measures BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, BDCP proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.

- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-1B-20. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP to benefit the California red-legged frog (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11, CM13, and CM20).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3)
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-20. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	1	1	0	0	NA	NA
	Upland	5	5	154	154	NA	NA
Total Impacts CM1		**6**	**6**	**154**	**154**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	8	24	0	0	0	0
Total Impacts CM2–CM18		**8**	**24**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**14**	**30**	**154**	**154**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 1B conservation measures would result in the permanent and temporary loss combined of up to 1 acre of modeled aquatic habitat and 183 acres of modeled upland habitat for California red-legged frog (Table 12-1B-20). There are no California red-legged frog occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction (CM1) and recreational facility construction for CM11. Construction activities associated with the water conveyance facilities and recreational facilities, including operation of construction equipment, could result in temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B, including transmission line construction, would result in the permanent loss of up to 1 acre of aquatic habitat and 5 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-1B-20). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 154 acres of upland habitat for the California red-legged frog (Table 12-1B-20).

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 4, *Covered Activities and Associated Federal Actions*, an estimated 24 acres of upland cover and dispersal habitat for the California red-legged frog would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation-related effects on California red-legged frog are expected to be minimal.

  Activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs listed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog.

- Critical habitat: Several conservation measures would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Conservation actions to protect and enhance grassland habitat for covered species, including California red-legged frog, in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation conservation actions described below and AMM1–AMM6, AMM10, AMM14, and AMM37 would reduce these effects.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of

California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facility construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of conveyance facilities construction would not be adverse under NEPA.

Alternative 1B would permanently remove approximately 1 acre of aquatic habitat and 167 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM11, 60 acres) and recreational facilities (CM11, 8 acres).

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 334 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM14 California Red-Legged Frog*, and *AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic and 7,766 acres of upland habitat for California red-legged frog. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 183 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 2% of the total upland habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

NEPA Effects: In the near-term, the loss of California red-legged frog habitat under Alternative 1B would be not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 1B as a whole on California red-legged frog would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impact of conveyance facilities construction would be less than significant under CEQA.

Alternative 1B would permanently remove approximately 1 acre of aquatic habitat and 167 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM11, 60 acres) and recreational facilities (CM11, 8 acres).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 334 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical

mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1-AMM6, AMM10, AMM14, and AMM37. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B on California red-legged frog would be less than significant, because the number of acres required to meet the typical ratios described above would be only 1 acre of aquatic habitat restored, 1 acre of aquatic habitat protected, and 183 acres of upland communities protected.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic and 7,766 acres of upland habitat for California red-legged frog. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 183 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 2% of the total upland habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

In the absence of other conservation actions, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1B would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 1B would be less than significant.

Impact BIO-45: Indirect Effects of Plan Implementation on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted in this area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 1B would avoid the potential for substantial adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on California red-legged frog.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance, as well as construction-related noise and visual disturbances including aritifical nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, construction, operation, and maintenance under Alternative 1B would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 1B would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While conservation measures implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 1B is expected to result in the temporary, permanent, and periodic removal of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-1B-21). Potential aquatic habitat for this species would not be affected. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP to benefit the California tiger salamander (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and CZ 11, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10

wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

- Increase the size and connectivity of protected vernal pool complex within the Plan Area and increase connectivity with protected vernal pool complex adjacent to the Plan Area (Objective VPNC1.3, associated with CM3).
- Protect the range of inundation characteristics that are currently represented by vernal pools throughout the Plan Area (Objective VPNC1.4, associated with CM3).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-21. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	0	0	0	0	NA	NA
	Upland	13	13	154	154	NA	NA
Total Impacts CM1		**13**	**13**	**154**	**154**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	292	634	0	0	191–639	0
Total Impacts CM2–CM18		**292**	**634**	**0**	**0**	**191-639**	**0**
TOTAL IMPACTS		**305**	**647**	**154**	**154**	**191–639**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 1B conservation measures would result in the permanent and temporary loss combined of up to 801 acres of modeled upland habitat for California tiger salamander (Table 12-1B-21). There are no California tiger salamander occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal natural community restoration (CM4), construction of recreational facilities (CM11), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California tiger salamander habitat. Each of these individual activities is described below. A summary statement of the combined impacts and a NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities, including transmission lines, would result in the permanent loss of 13 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-1B-21). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 154 acres of upland habitat for the California tiger salamander (Table 12-1B-21). The area that would be affected by conveyance facilities construction is south of Clifton Court Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent removal of approximately 42 acres of terrestrial cover and aestivation habitat for the California tiger salamander in the late-longterm. The modeled habitat in the Yolo Bypass is of low potential for California tiger salamander: There have been no observations of California tiger salamander in this area based on the results of a number of surveys for vernal pool invertebrates and plants and the bypass lacks vernal pool complexes with large, deep pools or large grassland areas with stock ponds and similar aquatic features that hold water long enough to provide potential breeding habitat for this species.

- *CM4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of approximately 517 acres of terrestrial cover and aestivation habitat in the study area in the late longterm. Tidal restoration in the Cache Slough area would result in habitat loss along the edges of Lindsey Slough and Duck Slough, and adjacent to cultivated land along the eastern edge of a block of modeled habitat. The modeled aquatic breeding habitat nearby the hypothetical tidal restoration footprint is of relatively high value, consisting of vernal pool complex along Lindsey Slough within the Jepson Prairie area in and near open space. The Jepson Prairie area includes numerous California tiger salamander CNDDB recorded occurrences and overlaps with Critical Habitat Unit 2, Jepson Prairie Unit, for this species, however, the hypothetical tidal restoration footprint does not overlap with critical habitat or recorded occurrences in this area. The tidal restoration at Lindsey Slough would occur along the northeastern edge of the Jepson Prairie block of habitat and would not contribute to fragmentation. Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because of the ability to select sites that minimize effects on California tiger salamander.

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 4, *Covered Activities and Associated Federal Actions*, an estimated 40 acres of terrestrial cover and aestivation habitat for the California tiger salamander would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, AMM37 requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California tiger salamander are expected to be minimal.

  Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values over the term of the BDCP. Activities associated with natural communities enhancement and management over the term of the BDCP in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- *CM18 Conservation Hatcheries*: This activity could result in the permanent removal of approximately 35 acres of terrestrial cover and aestivation habitat for California tiger salamander in the Yolo Bypass area (CZ 2). The specifications and operations of this facility have not been developed, although the facility is expected to be constructed near Rio Vista on cultivated lands in low-value habitat for the species

- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions. Tidal habitat would be restored approximately 2 miles east of SR 113, with some restoration taking place along the Barker and Lindsey Slough channels west to approximately SR 113 and a small amount (0.4 acre) taking place along the Lindsey Slough Channel west of SR 113 into Critical Habitat Unit 2.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1B would permanently remove approximately 459 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 167 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), and construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

Typical NEPA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 918 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes.

In addition, the plan contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander*, and *AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland habitat for California tiger salamander. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 801 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

NEPA Effects: In the near-term, the loss of California tiger salamander habitat under Alternative 1B would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California tiger salamander upland habitat associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–

AMM6, AMM10, AMM13, and AMM37, the effects of Alternative 1B as a whole on California tiger salamander would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant.

Alternative 1B would permanently remove approximately 459 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 167 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), and construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

Typical CEQA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 918 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation.

In addition, the plan contains commitments to implement AMM1–AMM6, AMM10, AMM13, and AMM37 which include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1B on California tiger salamander would be less than significant, because the number of acres required to meet the typical ratios described above would be only 918 acres of upland communities protected.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland habitat for California tiger salamander. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 801 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

In the absence of other conservation actions, the losses of California tiger salamander upland habitat associated with Alternative 1B would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction phase, the impacts of Alternative 1B as a whole on California tiger salamander would be less than significant.

Impact BIO-47: Indirect Effects of Plan Implementation on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conservation component construction and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical nighttime lighting, over the term of the BDCP. Most of the areas indirectly affected are associated with the construction of Byron Forebay and its borrow and spoil areas in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 1B would avoid or minimize the potential for substantial adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances including aritifical nighttime lighting could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 1B, the BDCP would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 1B would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement is the only conservation measure expected to result in periodic inundation of California tiger salamander habitat. Periodic inundation could affect from an estimated 191 acres of terrestrial habitat during a notch flow of 1,000 cfs, to an estimated 639 acres of terrestrial habitat in Yolo Bypass during a notch flow of 4,000 cfs in CZ 1 (Table 12-1B-21). This effect would only occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal terrestrial habitat for the California tiger salamander under Existing Conditions. No aquatic breeding habitat would be affected (Table 12-1B-21). The modeled habitat in the Yolo Bypass in the vicinity of terrestrial habitat is of low value in that there are no California tiger salamander records in this area and the bypass lacks vernal pool complexes with large, deep pools, or large grassland areas with stock ponds and similar aquatic features that provide the habitat of highest value for this species. Therefore, the terrestrial habitat that would be affected has a small likelihood of supporting California tiger salamanders, and Yolo Bypass operations are expected to have a minimal effect on the species, if any.

***NEPA Effects*:** The effects of periodic inundation from Alternative 1B would not have an adverse effect on California tiger salamander.

***CEQA Conclusion*:** Flooding of the Yolo Bypass from Fremont Weir operations would periodically increase the frequency and duration of inundation of 191–639 acres of terrestrial habitat for California tiger salamander. Because this area is considered low-value habitat and there are no California tiger salamander records in the area, and because of the lack of suitable breeding habitat in this area, the effects of periodic inundation of California tiger salamander habitat would have a less-than-significant impact.

Giant Garter Snake

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on the giant garter snake. The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic (except in Suisun Marsh), tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*; Hansen 2011), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-1B-22. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP to benefit the giant garter snake (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3 and CM11).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

- Of the at least 1,200 acres of nontidal marsh created under (Objective NFEW/NPANC1.1), create 600 acres of aquatic habitat giant garter snake aquatic habitat that is connected to the 1,500 acres of rice land or equivalent-value habitat described below in Objective GGS1.4 (Objective GGS1.1, associated with CM3, CM4, and CM10).
- Of the 8,000 acres of grassland protected under Objective GNC1.1 and 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of nontidal perennial habitat being restored and/or created in CZ 4 and/or CZ 5 (Objective GGS1.2, associated with CM3 and CM8).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands (Objectives GGS1.1 and GGS1.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS1.3, associated with CM3).
- Create connections from the White Slough population to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 1,500 acres may consist of tidal freshwater emergent wetland and may overlap with the 24,000 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria described in CM4. Up to 500 (33%) of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS1.4, associated with CM3 and CM4).
- Of the at least 1,200 acres of nontidal marsh created under Objective NFEW/NPANC1.1, create 600 acres of connected aquatic giant garter snake habitat outside the Yolo Bypass in CZ 2 (Objective GGS2.1, associated with CM3 and CM10).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland habitat adjacent to the 600 acres of nontidal marsh created in CZ 2 outside of Yolo Bypass (GGS2.1) (Objective GGS2.2, associated with CM3 and CM8).
- To expand upon and buffer the newly restored/created nontidal perennial habitat in CZ 2, protect 700 acres of cultivated lands, with 500 acres consisting of rice land and the remainder consisting of compatible cultivated land that can support giant garter snakes. The cultivated lands may be a subset of lands protected for the cultivated lands natural community and other covered species (Objective GGS2.3, associated with CM3).
- Protect giant garter snakes on created nontidal marsh (Objective GGS2.1) and created or protected adjacent uplands (Objective GGS2.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads, and establishing giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS2.4, associated with CM3).
- Protect, restore, and/or create 2,740 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 1, CZ 2, CZ 4, or CZ 5. Up to 500 acres may consist of tidal freshwater emergent wetland and may overlap with the at least 5,000 acres of tidally restored freshwater emergent wetland in the Cache Slough ROA if this portion meets giant garter snake habitat criteria specified in CM4. Up to 1,700 acres may consist of rice fields

in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*. Any remaining acreage will consist of rice land or equivalent-value habitat outside the Yolo Bypass. Up to 915 (33%) of the 2,740 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS3.1, associated with CM3, CM4, and CM10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-22. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 1B[a]

Conservation Measure[b]	Habitat Type[c]	Permanent NT	Permanent LLT[d]	Temporary NT	Temporary LLT[c]	Periodic[e] CM2	Periodic[e] CM5
CM1	Aquatic (acres)	120	120	146	146	NA	NA
	Upland (acres)	401	401	273	273	NA	NA
	Aquatic (miles)	21	21	32	32	NA	NA
Total Impacts CM1 (acres)		**521**	**521**	**419**	**419**		
CM2–CM18	Aquatic (acres)	179	498	15	38	NA	NA
	Upland (acres)	1,467	2,443	219	261	582–1,402	606
	Aquatic (miles)	49	189	9	10	NA	NA
Total Impacts CM2–CM18 (acres)		**1,646**	**2,941**	**234**	**299**	**582–1,402**	**606**
TOTAL IMPACTS CM1-CM18 (acres)		**2,167**	**3,462**	**653**	**718**	**582–1,402**	**606**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.
[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts on upland habitats only are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 1B conservation measures would result in the permanent and temporary loss combined of up to 802 acres of modeled aquatic habitat (tidal and nontidal combined), up to 3,378 acres of modeled upland habitat, and up to 252 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-1B-22). There is one giant garter snake occurrence that overlaps with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM (CM1), Fremont

Weir/Yolo Bypass improvements (CM2), tidal natural communities restoration (CM4), floodplain restoration (CM5), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of approximately 521 acres of modeled giant garter snake habitat, composed of 120 acres of aquatic habitat and 401 acres of upland habitat (Table 12-1B-22). The 401 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 166 acres of high-, 218 acres of moderate-, and 17 acres of low-value habitat. In addition, approximately 21 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of 419 acres including 146 acres of giant garter snake aquatic habitat and up to 273 acres of adjacent upland habitat in areas near construction in CZ 4, CZ 5, CZ 6, and CZ 8 (see Table 12-1B-22 and Terrestrial Biology Map Book). In addition, approximately 32 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction.

  Most of the habitat that would be lost is located in the eastern Delta, in CZ 4, CZ 5, CZ 6, and CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Water facilities construction and operation is expected to have low to moderate potential for adverse effects on giant garter snake aquatic habitat in CZ 6 and CZ 8 which consists primarily of agricultural fields but is not located near or between subpopulations identified in the draft recovery plan The aquatic habitat that would be affected in CZ 4 and CZ 5 is of moderate to high value because portions of it are approximately 0.7 to 1.5 miles west of 3 recorded CNDDB giant garter snake occurrences which are part of the Coldani Marsh/White Slough subpopulation identified in the draft recovery plan.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 83 acres of aquatic habitat and 458 acres of upland habitat for the giant garter snake in the late long-term. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Most of this habitat removal would occur at the north end of the Yolo Bypass, near Fremont Weir. Construction is expected to have adverse effects on giant garter snake aquatic habitat in the Yolo Bypass area because it is near the Yolo Basin/Willow Slough subpopulation. The upland habitat that would be removed is composed of 336 acres of high-value, 121 acres of moderate-value, and 1 acre of low-value habitat.

  In addition to habitat loss from construction related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice is 1,662 acres.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 395 acres of aquatic habitat and 2,123 acres of upland habitat for the giant garter snake to tidal marsh in the late long-term. The upland habitat affected by tidal inundation includes 594 acres of high-value, 1,375 acres of moderate-value, and 154 acres of low-value habitat. In addition, approximately 138 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration.

  Most of the effects of tidal natural communities restoration would occur in the Cache Slough and Yolo Bypass areas (CZ 1 and CZ 2). This aquatic habitat is of low to moderate value: it is in and near Category 1 open space but is not near any giant garter snake occurrences and is not near or between giant garter snake subpopulations identified in the draft recovery plan. Tidal natural communities restoration is expected to have little to no adverse effects on giant garter snake aquatic or upland habitat in the Cache Slough ROA. There are no giant garter snake occurrences in this area, which is already tidally influenced so it has limited value for the giant garter snake (giant garter snakes may occur in tidally muted areas but are not likely to use aquatic areas with a strong tidal influence).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 89 acres of upland habitat for giant garter snake. The upland habitat to be removed is composed of 51 acres of moderate-value and 38 acres of low-value upland habitat. Approximately 2 miles of channels providing giant garter snake movement habitat would be removed as a result of floodplain restoration. Seasonally inundated floodplain restoration is expected to have little to no adverse effects on giant garter snake aquatic habitat because the site is not located near or between giant garter snake populations identified in the draft recovery plan. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on giant garter snake habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, AMM37requires setbacks for trails in giant garter snake habitat (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). With this measure in place, recreation-related effects on giant garter snake are expected to be minimal,

- *CM18 Conservation Hatcheries*: Construction for conservation hatcheries could result in the permanent removal of 35 acres of moderate-value upland habitat for the giant garter snake in the Yolo Bypass area (CZ 2).

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the two subpopulations: Yolo Basin/Willow Slough [CZ 2] and the Coldani Marsh/White Slough [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction, as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1B would permanently and temporarily remove 460 acres of aquatic habitat and 2,360 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 266 acres of aquatic and 674 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration. (CM4, 111 acres of aquatic and 1,193acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 111 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 460 acres of aquatic habitat should be restored, 460 acres of aquatic habitat should be protected, and 4,720 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses. The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 460 acres of aquatic communities restored, 460 acres of aquatic communities protected, and 4,720 acres of upland communities protected.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities, AMM16 Giant Garter Snake, and AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 802 acres of aquatic habitat and 3,378 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat in the study area and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS3.1would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

NEPA Effects: In the near-term, the loss of giant garter snake habitat under Alternative 1B would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of giant garter snake associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM7, AMM10, AMM16, and AMM37, the effects of Alternative 1B as a whole on giant garter snake would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 1B would permanently and temporarily remove 460 acres of aquatic habitat and 2,360 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 266 acres of aquatic and 674 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and Conservation Hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 111 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 460 acres of aquatic habitat should be restored, 460 acres of aquatic habitat should be protected, and 4,720 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be less than significant, because the number of acres required to meet the typical ratios described above would be only 460 acres of aquatic communities restored, 460 acres of aquatic communities protected, and 4,720 acres of upland communities protected.

The Plan also includes commitments to implement AMM1-AMM7, AMM10, AMM16, and AMM37. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 802 acres of aquatic habitat and 3,378 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat in the study area and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under

Objective GGS3.1would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

The BDCP also includes AMM1–AMM7, AMM10, AMM16, and AMM37, all of which are directed at minimizing or avoiding potential impacts on adjacent habitats during construction and operation of the conservation measures. Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1B as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of giant garter snake habitat and potential mortality of snakes would have a less-than-significant impact on giant garter snake.

Impact BIO-50: Indirect Effects of Plan Implementation on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect throughout the plan's construction phase.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey. Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under CM1 were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and floodplains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with avoidance and minimization measures and adaptive management and monitoring, *CM12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities and floodplains.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the Central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Effects on giant garter snake from increased methylmercury exposures is more likely in the Yolo Basin, where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008). Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). Planned floodplain restoration activities in the Yolo Basin are expected to seasonally increase methylmercury production, although production would be minimized by *CM12 Methylmercury Mitigation*, Further, the periods of production and increased exposure to methylmercury do not overlap with giant garter snake seasonal activity periods. This seasonal trend should help to decrease risk to the giant garter snake, although snakes could prey on individuals that have been exposed to methylmercury during the previous season.

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and will need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 is expected to reduce the effects of methylmercury resulting from BDCP natural communities and floodplain restoration on giant garter snake.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1B would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications and fragmentation. These AMMs would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on giant garter snake.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37 as part of Alternative 1B construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications and fragmentation. Alternative 1B would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the indirect effects of Alternative 1B would have a less-than-significant impact on giant garter snakes.

Giant garter snake could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes, and, therefore, would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Construction of Alternative 1B water conveyance facilities would create a substantial barrier to movement for the Coldani Marsh/White Slough subpopulation of giant garter snake. The facilities would eliminate Coldani Marsh/White Slough subpopulation connectivity with areas containing current or previous occurrences of giant garter snake, specifically in the vicinity of Stone Lakes NWR to the north and in the Delta to the southwest (Figure 12-15B). An unknown number of small agricultural ditches and drains between Disappointment Slough and Stone Lakes would be lost, rerouted, or directed into culverts and affect species' movements and connectivity. Siphons would be constructed underneath sloughs (Disappointment Slough, White Slough, Sycamore Slough, Hog Slough, and Beaver Slough) and Stone Lakes Drain, and a tunnel would be constructed under the Lost Slough/Mokelumne River area that connects with Snodgrass Slough. These sloughs and drains would still provide aquatic habitat and opportunities for movement and connectivity between giant garter snakes in the vicinity of Stone Lakes NWR and the Coldani Marsh/White Slough subpopulation. In addition, although Upland Canal, an important aquatic habitat for giant garter snakes adjacent to the Coldani Marsh, would be cut off from White Slough by the new canal it would still retain connectivity through Dredger Cut to the south (Figure 12-15B). Maintaining connectivity between major sloughs in the vicinity of White Slough is important for the long-term survival and conservation of the giant garter snake in the Plan Area.

The Coldani Marsh/White Slough giant garter snake subpopulation is located within the White Slough Wildlife Area (WSWA) managed by CDFW for hunting and fishing. In 2009 and 2010, Eric Hansen (consulting environmental biologist and giant garter snake expert) surveyed this area as part of a status survey to provide information for USFWS' 5-year review of giant garter snake. Mr. Hansen captured a total of 27 individual giant garter snakes in the Upland Canal along the west and southwest edges of the Coldani Marsh (Hansen 2011). Giant garter snakes were not captured or observed in any of the ponds or in any of the emergent tidal marshes adjacent to Dredger Cut at WSWA despite the close proximity and connectivity among habitats (Hansen 2011). This might be partially due to the fact that Coldani Marsh provides more suitable habitat for giant garter snakes because the tidal influence is strongly muted, allowing for consistent water supply unlike some of the emergent tidal marshes adjacent to Dredger Cut, and there is limited access for large aquatic predators such as largemouth and striped bass in contrast to adjacent ponds. Mr. Hansen noted that while he did not have access to conduct surveys, several locations near Coldani Marsh and Upland Canal, including Disappointment Slough, eastern Sycamore Slough, Dredger Cut, and Hog Slough, contain promising habitat in the study area (Hansen pers. comm.). In addition, Mr. Hansen stated that there have been recent sightings of giant garter snake in the vicinity of Little Connection Slough and Empire Tract approximately 6 miles southwest of the Coldani Marsh/White Slough population (Figure 12-15B).

Protecting and expanding existing giant garter snake subpopulations, and providing connectivity among protected areas, are considered the most effective approaches to giant garter snake conservation in the study area. The Plan calls for restoration and protection activities for giant garter snakes in the vicinity of Coldani Marsh/White Slough and Stone Lakes NWR to protect, conserve, and expand giant garter snake populations. Restoration and protection activities would occur in the vicinity of the Coldani Marsh/White Slough subpopulation, including the creation of 600 acres of aquatic habitat for the giant garter snake that is adjacent to the 1,500 acres of rice land or equivalent-value habitat (Objective GGS1.1). Objective GGS1.2 would be to create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of aquatic habitat restored or created in CZ 4 and CZ 5. The Plan also calls for creation of connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's range in the vicinity of Stone Lakes NWR by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat for the giant garter snake in CZ 4 and/or CZ 5 (Objective GGS1.4). Up to 500 of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake. A portion of this would occur in CZ 4 and CZ 5 and in the vicinity of the Coldani Marsh/White Slough subpopulation.

***NEPA Effects*:** Restoration and protection of aquatic and upland habitat in CZ 4 and CZ 5 would improve and create giant garter snake connectivity within the study area; however, construction of

Alternative 1B water conveyance facilities would reduce the effectiveness of these habitats by creating a barrier to movement that extends from Stone Lakes NWR south towards the Coldani Marsh/White Slough subpopulation, and by creating a barrier to the Delta southwest of Coldani Marsh/White Slough. The creation of a substantial barrier and loss of movement corridors among giant garter snake subpopulations would have an adverse effect on giant garter snake. Implementation of Mitigation Measure BIO-50a, *Provide Connectivity among Coldani Marsh/White Slough, Stone Lakes Wildlife Refuge, and the Delta*, would avoid the potential for substantial adverse effects on giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Mitigation measure implementation would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, with implementation of Mitigation Measure BIO-50a, the loss of habitat connectivity resulting from Alternative 1B would not have an adverse effect on giant garter snake.

CEQA Conclusion: Alternative 1B water conveyance facilities would create a substantial barrier to the movement of giant garter snake in the area between the Coldani Marsh/White Slough subpopulation and Stone Lakes NWR, as well as between the Coldani Marsh/White Slough subpopulation and the Delta to the southwest. Restoration and protection activities would occur in the vicinity of the Coldani Marsh/White Slough subpopulation, including the creation or protection of 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of aquatic habitat restored or created in CZ 4 and CZ 5 (Objective GGS1.2). The Plan also calls for creation of connections between the Coldani Marsh/White Slough subpopulation and other areas near the giant garter snake's range in vicinity of Stone Lakes NWR by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat for the giant garter snake in CZ 4 and/or CZ 5. While restoration and protection of aquatic and upland habitat in CZ 4 and CZ 5 would improve and create giant garter snake movement corridors within the study area, construction of Alternative 1B water conveyance facilities would reduce the effectiveness of these habitats by creating a substantial barrier between Stone Lakes NWR and the Coldani Marsh/White Slough subpopulation, and a barrier between the Coldani Marsh/White Slough population and the Delta to the southwest.

The Alternative 1B conveyance facilities would result in a significant impact on connections among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes NWR, and the Delta. This impact would be reduced to a less-than-significant level with the implementation of Mitigation Measure BIO-50a, *Provide Connectivity among Coldani Marsh/White Slough, Stone Lakes National Wildlife Refuge, and the Delta*.

Mitigation Measure BIO-50a: Provide Connectivity among Coldani Marsh/White Slough, Stone Lakes National Wildlife Refuge, and the Delta

DWR will protect, create, and restore aquatic and upland habitats with the specific goal of providing connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes NWR, south Delta, and the Delta. Of the 6,540 acres of high-value habitat targeted specifically for the giant garter snake DWR will ensure that connectivity is maintained by focusing restoration/protection on high ground on the eastern side of the canal to promote connectivity in the areas noted above. DWR will provide irrigation and drainage channels or possibly toe drains along the Alternative 1B water conveyance facilities that could provide aquatic habitat for the giant garter snake through the protection and management of cultivated lands in these areas (CM3 and CM11). These irrigation and drainage channels and ditches would connect to those sloughs described above that would be siphoned or tunneled under and would still provide aquatic habitat and connectivity for giant garter snakes within the study area. Providing aquatic habitat would be especially important in CZ 4 and CZ 5 where the Alternative 1B water conveyance facilities would disrupt smaller waterways preferred by giant garter snakes. In addition, DWR will work with CDFW to manage the White Slough Wildlife Area ponds and adjacent upland for giant garter snake. Management activities could include removing large aquatic predators and creating more emergent marsh and upland areas to provide escape cover and foraging opportunities.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement: The proposed changes in Fremont Weir operations would occur intermittently from as early as mid-November through as late as mid-May. The core operations would occur during the winter/spring period, which corresponds mostly with the giant garter snake's inactive season. During this time, snakes are overwintering underground. Giant garter snakes that occur in the bypass during the active season could potentially overwinter in the bypass during the inactive season: these snakes may be vulnerable to inundation of the bypass and could be drowned or displaced from overwintering sites. However, most typically, Fremont Weir "notch" operations would occur on the shoulders of time periods in which the Sacramento River rises enough for Fremont Weir to overtop passively, without the proposed project. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Duration of inundation may also be an important factor determining effects on overwintering giant garter snakes. Radiotelemetry studies have revealed giant garter snakes surviving in burrows that had been inundated for 2 to 3 weeks, but it is unknown what duration of inundation the snakes can survive while overwintering in their burrows.

Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants,* provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect giant garter snakes overwintering in upland areas ranging from an estimated 582 acres of upland habitat during notch flow of 1,000 cfs to an estimated 1,402 acres during a 4,000-cfs notch flow. The 4,000-cfs notch flow would affect an estimated 888 acres of high value habitat and 514 acres of moderate value habitat.

As noted above under the discussion of habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of a maximum of 1,662 acres of rice fields (BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass).* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term. Restoration and protection of 2,740 acres of rice land or habitat of equivalent value for the giant garter snake would achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2).*CM5 Seasonally Inundated Floodplain Restoration* would periodically inundate 606 acres of upland habitat for the giant garter snake in the south Delta (CZ 7). The upland habitat to be inundated contains 432 acres of moderate-value and 174 acres of low-value habitat. The area between existing levees would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The restored floodplain will include a range of elevations from low-lying areas that flood frequently (e.g., every 1 to 2 years) to high-elevation areas that flood infrequently (e.g., every 10 years or more). There are no records of giant garter snakes in the vicinity of where floodplain restoration is expected to occur.

Based on modeled habitat for the giant garter snake, the study area supports approximately 53,285 acres of upland habitat for giant garter snake. Approximately 2,008 acres of giant garter snake upland habitat (4% of total upland habitat in the study area) may be adversely affected by periodic flooding as a consequence of floodplain restoration and the operation of the Fremont Weir.

NEPA Effects: Periodic effects on upland habitat for giant garter snake associated with implementing Alternative 1B are not expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, periodic inundation of giant garter snake habitat under Alternative 1B would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass from CM2 and creation of seasonally inundated floodplain in various parts of the study area (CM5) would periodically affect a total of approximately 2,008 acres of upland habitat for giant garter snake. The inundation could affect overwintering snakes. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that will be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.).

Therefore, increased inundation in the Yolo Bypass as a result of BDCP is expected to have a minimal effect on the Yolo Basin/Willow Slough population. Therefore, implementing Alternative 1B, including AMM1–AMM7, AMM10, and AMM16, would not be expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Periodic inundation under Alternative 1B would have a less-than-significant impact on the species.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, Section 2A.30 *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-1B-23. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP to benefit the western pond turtle (BDCP Chapter 3, *Conservation Strategy*).

- Protect or restore 142,200 acres of high-value natural communities and covered species habitats (Objective L1.1, associated with CM3).
- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise. Minimum restoration targets for tidal natural communities in each ROA are 7,000 acres in Suisun Marsh ROA, 5,000 acres in Cache Slough ROA, 1,500 acres in Cosumnes/Mokelumne ROA, 2,100 acres in West Delta ROA, and 5,000 acres in South Delta ROA (Objective L1.3, associated with CM2, CM3, and CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands (Objective L1.3), include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM3, CM4, and CM8).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Allow lateral river channel migration (Objective L2.2, associated with CM3 and CM5).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect and enhance 8,100 acres of managed wetland, 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3 and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors,

water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-23. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 1B[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic (acres)	48	48	103	103	NA	NA
	Upland[e] (acres)	190	190	86	86	NA	NA
	Aquatic (miles)	19	19	24	24	NA	NA
Total Impacts CM1 (acres)		**238**	**238**	**189**	**189**		
CM2–CM18	Aquatic (acres)	82	114	23	44	NA	NA
	Upland (acres)	414	1,028	119	136	283–798	331
	Aquatic (miles)	25	109	3	4	NA	NA
Total Impacts CM2–CM18 (acres)		**496**	**1,142**	**142**	**180**	**283–798**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**734**	**1,380**	**331**	**369**	**283–798**	**331**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
[e] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 1B conservation measures would result in the permanent and temporary loss of up to 309 acres of aquatic habitat and 1,440 acres of upland nesting and overwintering habitat (Table 12-1B-23). There are 3 western pond turtle occurrences that overlap with the CM1 footprint and a number of additional occurrences within the vicinity (Figure 12-16). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), seasonally inundated floodplain restoration (CM5), and riparian restoration (CM7). Habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western pond turtle habitat. The activity accounting for most (80%) of the habitat loss or conversion would be *CM4 Tidal Natural Communities Restoration.* Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of approximately 48 acres of aquatic habitat and 190 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-1B-23). Development of the water conveyance facilities would also result in the temporary removal of up to 103 acres of aquatic habitat and 86 acres of nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-1B-23). Approximately 19 miles of channels providing western pond turtle movement habitat would be removed and 24 miles would be temporarily disturbed. There are three western pond turtle occurrences that overlap with the CM1 footprint in CZ 2 around Clifton Court Forebay and in CZ 5 scattered throughout the Delta. The majority of the permanent loss of aquatic habitat and nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering and dispersal habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. While there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the canal footprint.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 60acres of aquatic habitat and 249 acres of upland nesting and overwintering habitat for the western pond turtle. Approximately 4 miles of channels providing western pond turtle movement habitat would be permanently or temporarily removed as a result of Yolo Bypass improvements. Although there are no CNDDB occurrences for western pond turtle in the Yolo Bypass, the species is known to be present in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2013).

- *CM4 Tidal Natural Communities Restoration*: Tidal natural community restoration would result in the conversion of approximately 45 acres of aquatic habitat and 872 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Approximately 106 miles of channels providing western pond turtle movement habitat would be removed as a result of restoration. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration outside Suisun Marsh is likely to create suitable, slow-moving freshwater slough and marsh habitat.

  Although the aquatic habitat model includes all tidal perennial aquatic, tidal brackish emergent wetland, and managed wetland as habitat, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not hydrologically connected to Suisun Marsh (Patterson pers. comm.). While the model does not include an aquatic class type called drainage ditches and therefore an effect on this habitat type cannot be calculated, it is likely that this general type of habitat accounts for a very small portion of the total modeled aquatic effects; almost certainly less than 5%, or less than 287 acres of the modeled aquatic habitat affected by tidal restoration. The suitable nesting and overwintering habitat that would be affected in the interior of Suisun Marsh is limited, because the levees likely function as the primary nesting and overwintering habitat. The nesting and overwintering habitat of highest value to be affected is on the fringe of the marsh where the aquatic habitat is adjacent to undeveloped grassland habitat. The habitat affected in the interior Delta (West Delta and South Delta) is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle

Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 53 acres of aquatic habitat 33 acres of upland habitat for western pond turtle. Approximately 3 miles of channels providing western pond turtle movement habitat would be removed as a result of floodplain restoration. Although there are no CNDDB occurrences of the western pond turtle in the areas where floodplain restoration is likely to occur, the species is known to occur along the San Joaquin River to the south in the San Joaquin River National Wildlife Refuge. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration that is part of tidal natural communities restoration in CZ 1 and CZ 2, would result in the permanent removal of 10 acres of upland nesting and overwintering habitat for western pond turtle.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values over the term of the BDCP. In addition, effects would be avoided and minimized by the AMMs listed below.

- Management of the 6,600 acres of managed wetlands to be protected for waterfowl and shorebirds is not expected to result in overall adverse effects for the western pond turtle. Management actions that would improve wetland quality and diversity on managed wetlands include control and eradication of invasive plants; maintenance of a diversity of vegetation types and elevations, including upland areas to provide flood refugia; water management and leaching to reduce salinity; and enhancement of water management infrastructure (improvements to enhance drainage capacity, levee maintenance). These management actions could benefit the western pond turtle. The 6,600 acres of protected managed wetlands would be monitored and adaptively managed to ensure that management options are implemented to avoid adverse effects on the western pond turtle.

- Operations and maintenance: Ongoing maintenance of BDCP facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and conservation actions described below.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where conservation measures are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1B would remove 256 acres of aquatic habitat and 809 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 151 acres of aquatic and 276 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat), and riparian restoration (CM7, 4 acres of upland habitat). Typical project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 256 acres of aquatic habitat should be restored, 256 acres of aquatic habitat should be protected, and 1,618 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1).

In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation. Because the number of acres required to meet the typical ratios described above would be only 256 acres of aquatic communities protected, 256 acres restored, and 1,618 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1B on western pond turtles would not be adverse.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM17 Western Pond Turtle.* These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for giant garter snake. Alternative 1B would remove 309 acres of aquatic habitat and 1,440 acres of upland nesting and overwintering habitat for western pond turtle in the late long--term.

Implementation of Alternative 1B as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

NEPA Effects: In the near-term, the loss of western pond turtle habitat under Alternative 1B would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of western pond turtle habitat associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, the effects of Alternative 1B as a whole on western pond turtle would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant.

Alternative 1B would remove 256 acres of aquatic habitat and 809 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 151 acres of aquatic and 276 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat), and riparian restoration (CM7, 4 acres of upland habitat). Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 256 acres of aquatic habitat should be restored, 256 acres of aquatic habitat should be protected, and 1,618 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation for CEQA purposes. Because the number of acres required to meet the typical ratios described above would be only 256 acres of aquatic communities protected, 256 acres restored, and 1,618 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1B on western pond turtles would be less than significant.

In addition, the plan also contains commitments to implement AMM1–AMM6, AMM10, and AMM17, which include elements that would avoid or minimize the risk of directly and indirectly affecting habitats and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for giant garter snake. Alternative 1B would remove 309 acres of aquatic habitat and 1,440 acres of upland nesting and overwintering habitat for western pond turtle in the late long--term.

Implementation of Alternative 1B as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

The loss of western pond turtle habitat associated with Alternative 1B would represent an adverse effect as a result of special-status species habitat modification and the potential direct mortality of turtles. However, considering the habitat restoration and protection associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, which would be in place throughout the construction phase, the loss of habitat and potential mortality would not have an adverse effect on western pond turtle. Therefore, the loss of western pond turtle habitat and potential mortality of turtles from Alternative 1B would be less than significant.

Impact BIO-53: Indirect Effects of Plan Implementation on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting, overwintering, and dispersal habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances over the term of the BDCP.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

Water operations would affect salinity gradients in Suisun Marsh. This effect mechanism cannot be disaggregated from tidal natural community restoration in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operation of salinity control gates to mimic a more natural water flow. Results of modeling for full implementation of the BDCP show salinity to double by the late long-term compared with current conditions during late fall and winter months. Changes in salinity would not be uniform across Suisun Marsh, as salinity would likely be more pronounced in some tidal channels and sloughs than others, and most of the salinity increase would occur during the fall and winter. Western pond turtles are primarily a freshwater species, although they can also be found in brackish marsh, and could respond negatively to increased salinity in Suisun Marsh. However, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not connected to tidal channels and sloughs in Suisun Marsh which is where increases in salinity would occur. Therefore, the potential effects associated with changes in salinity are not expected to adversely affect western pond turtles.

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 1B, the BDCP would avoid the potential for adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. Changes in water salinity would have a less-than-significant impact on western pond turtles because most of the salinity increases would occur in areas not used extensively by western pond turtles. With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 1B construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 1B would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement would result in periodic inundation that could affect western pond turtle and its upland habitat. BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect from an estimated 283 acres of habitat during 1,000 cfs notch flow to an estimated 798 acres of habitat during 4,000 cfs notch flow (Table 12-1B-23). This effect would occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal overwintering habitat for the western pond turtle under Existing Conditions. Furthermore, Yolo Bypass inundation is not expected to affect nesting western pond turtles because operations would not occur during the nesting season (approximately May through October). Therefore, Yolo Bypass operations are expect to have a minimal effect, if any, on western pond turtles in the Yolo Bypass.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 331 acres of upland habitat for the western pond turtle in the south Delta (CZ 7Seasonal flooding in restored floodplains is not expected to adversely affect aquatic and dispersal habitat, because these habitat functions are expected to remain in the seasonally inundated floodplains). Floodplains are not expected to be inundated during the nesting season; however, turtle hatchlings may overwinter in the nest and could be affected by flooding. Restored floodplains would transition for areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more); adverse effects on turtle hatchlings are most likely at the lower elevations of the restored floodplain, where frequent flooding occurs.

NEPA Effects: Periodic inundation of upland habitat for western pond turtle from CM2 and CM5 associated with implementing Alternative 1B is not expected to result in adverse effects either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Therefore, periodic inundation of western pond turtle habitat under Alternative 1B would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect a total of up to 283-798 acres from CM2 and approximately 331 acres from CM5 of upland habitat for western pond turtle These acreages represent only 1% of the total upland western pond turtle habitat in the study area. Most of the increase in inundation would occur in the winter and early spring months, when western pond turtles may be in the water or overwintering and occupying upland habitats. Therefore, implementing Alternative 1B, including AMM1–AMM6, AMM10, and AMM17, would not be expected to result in substantial adverse effects on western pond turtle, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Periodic inundation under Alternative 1B would have a less-than-significant impact on the species.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 1B on the silvery legless lizard, San Joaquin coachwhip and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10), which would not be affected by construction or restoration activities. This species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the whipsnake in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4) Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013). In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Alternative 1B is expected to result in the temporary and permanent removal of habitat that special-status reptiles uses for cover and dispersal (Table 12-1B-24). BDCP actions that could affect this habitat are limited to construction and maintenance of the water conveyance facilities in the vicinity of Clifton Court Forebay, and grassland restoration, protection and management. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP that would also benefit special-status reptiles (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-24. Changes in Special-Status Reptile Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	170	170	165	165	NA	NA
Total Impacts CM1		**170**	**170**	**165**	**165**	**NA**	**NA**
CM2–CM18	Grassland	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS CYL/SJW		**170**	**170**	**165**	**165**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 1B conservation measures would result in the permanent and temporary loss of 335 acres of potential habitat for special-status reptiles (Table 12-1B-24). Water conveyance facilities and transmission line construction, including establishment and use of RTM, borrow and spoils areas, (CM1) would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effect are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though this would result in slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4 where it does not occur.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, potentially impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to conservation components could have similar affects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 170 acres of potential habitat for special-status reptiles in the vicinity of Clifton Court Forebay and Stone Lakes. Construction-related effects would temporarily disturb 165 acres for both species in the study area.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicles may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. *P. blainvillii* may only be active during the early morning and evening hours in the summer (Morey 2000). Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1B would remove 335 acres of grassland habitat for California horned lizard and 341 acres of grassland habitat for San Joaquin whipsnake under CM1. The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that up to 670 acres should be protected for both species in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55. to avoid and minimize injury or mortality of special-status reptiles during construction, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species from Alternative 1B would not be an adverse effect.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of up to 335 acres of special-status reptile habitat over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan area. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because the Alternative 1B would result in a net increase in acreage of grassland habitat in the Plan Area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

NEPA Effects: In the near-term and late long-term, the loss of special-status reptile habitat under Alternative 1B would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In addition, Mitigation Measure BIO-55 would be available to address effects of habitat loss.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant.

Alternative 1B would remove 335 acres of special-status reptile habitat as a result of CM1.

The typical CEQA mitigation ratio (2:1 for protection) for this natural community would indicate that up to 670 acres should be protected for both species in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough to the timing of construction impacts to constitute mitigation for CEQA purposes. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species would be a less-than-significant impact.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of up to 335 acres of special-status reptile habitat over the life of the plan. Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan area (Objective GNC1.1 and Objective GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other impacts would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall impact would be beneficial because Alternative 1B would result in a net increase in acreage of grassland habitat in the study area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the impacts resulting from water conveyance facilities construction. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species under Alternative 1B would not result in a significant impact.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support noncovered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work area, the biologist will first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas of suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* would be implemented for all noncovered special-status reptiles adversely affected by the BDCP to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Plan Implementation on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat over the term of the BDCP. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of AMM10 *Restoration of Temporarily Affected Natural Communities*.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

NEPA Effects: Implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*, would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measures would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 1B on special-status reptiles would not be an adverse effect under NEPA.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present. With implementation of Mitigation Measure BIO-55 as part of Alternative 1B construction, operation, and maintenance, the BDCP would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 1B would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on California black rail. The habitat model used to assess effects on the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta consists of all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially, instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat consists of all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones, providing refugia during high tides, within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-1B-25. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the California black rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 1,700 acres of black rail habitat between restored tidal freshwater emergent wetlands and transitional uplands to provide upland refugia (Objective CBR1.1, associated with CM4).
- Create topographic heterogeneity in restored tidal brackish and freshwater emergent wetlands (Objectives TBEWNC1.4 and TFEWNC2.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and implementation of AMM1–AMM7, AMM38 *California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-25. Changes in California Black Rail Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	3	3	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**3**	**3**	**NA**	**NA**
CM2–CM18	Primary	76	84	0	0	0	0
	Secondary	986	3,044	0	0	0	0
Total Impacts CM2–CM18		**1,062**	**3,128**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,062**	**3,128**	**3**	**3**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 87 acres of modeled primary habitat and up to 3,044 acres of modeled secondary habitat for California black rail (Table 12-1B-25). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1) and tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below. A summary statement of the combined NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the temporary loss of up to 3 acres of modeled primary California black rail habitat (Table 12-1B-25). Activities that would impact modeled habitat consist of consists of potential temporary siphon work areas at White Slough and south of King Island in CZ 5 and a proposed temporary transmission line east of the new forebay in CZ 8. The CM1 footprint intersects with one California black rail occurrence south of Sycamore Slough, from the footprint of a temporary work area. The implementation of *AMM38 California Black Rail* would minimize the effects of construction on rails if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. These losses would take place within the first 10 years of Alternative 1B implementation.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction or channel modification from fish passage improvements associated with the Yolo Bypass would result in the permanent removal of approximately 5 acres of primary California black rail habitat in CZ 2. The loss would be expected to occur during the first 10 years of Alternative 1B implementation. There are no occurrences of California black rail that intersect with the CM2 footprint.
- *CM4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be affected by tidal marsh restoration. Some California black rail modeled habitat would be permanently lost such that it no longer serves as habitat, while other modeled habitat would change value through conversion from one habitat type to another. Tidal habitat restoration site preparation and inundation would result in the permanent loss of 79 acres of primary habitat and 3,044 acres of secondary habitat for California black rail. Of the 79 acres of primary habitat lost, an estimated 76 acres would be converted to low marsh, or secondary habitat, for the species due to increased water elevations.

  The majority of the effects of tidal natural communities restoration would occur in Suisun Marsh (CZ 11). Much of the natural wetland habitat that would be removed occurs in isolated patches and would be replaced by larger continuous areas of tidal wetlands that are expected to support higher habitat functions for the rail than the impacted wetlands. As described in the BDCP, restoration of up to 24,000 acres of tidal freshwater emergent wetland in the Delta and at least 6,000 acres of tidal brackish emergent wetland natural communities in CZ 11 by the late long-term would benefit California black rail. The primary habitat for the species in the Delta consists of inchannel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under CM4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration projects would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before the initiation of restoration actions in other areas. However, California black rails have a greater use of mature tidal marshes and, therefore, it would be years before the newly restored marshes provided suitable habitat for the species. In the long-term, tidal natural communities restoration is expected to have little to no adverse effects on California black rail habitat because the habitat removed would be replaced by a greater acreage of high-value tidal wetland and, thus, is expected to provide a benefit for California black rail.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions contained in CM11 that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values over the term of the BDCP. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below. Additional actions under CM11 include the control of nonnative predators to reduce nest predation as needed.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the surrounding habitat in Suisun and the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California black rail. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction outside of the breeding season where feasible (reducing the risk of impacting active nests), construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of the species during construction, as required by AMM1–AMM7 and *AMM38 California Black Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1B implementation, there would be a loss of 1,065 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 3 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*—76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 3 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1, BDCP Chapter 3, *Conservation Strategy*) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California black rail satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 87 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

NEPA Effects: The loss of California black rail habitat and potential direct mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by the biological objectives for the species and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*, which would be in place throughout the construction period, the effects of Alternative 1B as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1B implementation, there would be a loss of 1,065 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 3 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 3 acres of tidal natural communities should be restored/created to mitigate the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM38 California Black Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 3,608 acres of restored/created tidal natural communities, the 10,850 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for California black rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 87 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California black rail.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of California black rail. A variety of rail species are known to suffer mortality from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al 1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires. California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al 1994). However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would eliminate any potential for mortality of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for transmission lines constructed in the Delta to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines and select existing powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the

Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California black rail because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Plan Implementation on California Black Rail

Indirect Construction-Related Effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in AMM38 that preconstruction surveys of potential breeding habitat would be conducted within 700 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure:

The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, Substantive BDCP Revisions). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008); however, the majority of the overlap between restoration areas and black rail habitat is within Suisun Marsh, where conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Conservation Measure CM 12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on California black rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California black rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of AMM27, *Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances related to construction-related activities from conservation measures could disturb California black rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California black rail would be minimized with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions. Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is Black Rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities and other conservation measures could disturb primary and secondary California black rail habitat adjacent to work sites. *AMM38 California Black Rail* would avoid and minimize impacts on California black rail from noise and visual disturbance. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species. These impacts on California black rail would be less than significant with the incorporation of AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and could temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *CM4 Tidal Natural Community Restoration* activities. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

***NEPA Effects*: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would not result in the periodic inundation of modeled habitat for California black rail. There are no records for California black rails in the Yolo Bypass, although the species is highly secretive and the extent to which the area has been surveyed for California black rails is unknown. Therefore, there is potential for the species to occur in the Yolo Bypass. In addition, rails may occur in the bypass after restoration activities are completed. However, periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in increased magnitude, frequency and duration of periodic inundation by up to 6 acres of modeled California black rail habitat in CZ 7. The risk of changes in inundation frequency, magnitude, and duration through CM2 and CM5 affecting California black rail are considered to be low, and would not be expected to result in adverse effects on the species.

NEPA Effects: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration through CM2 and CM5 affecting California black rail is considered to be low.

CEQA Conclusion: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would represent a less-than-significant impact on California black rail because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration as a result of CM2 and CM5 affecting California black rail is considered to be low

California Clapper Rail

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on California clapper rail. California clapper rail habitat includes mostly middle marsh habitat with select emergent wetland plant alliances. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and forage. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Covered Species Accounts*.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-1B-26. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the California clapper rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, AMM19 *California Clapper Rail*, and *AMM27 Selenium Management*, impacts on the California clapper rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-26. Changes to California Clapper Rail Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	26	27	0	0	0	0
	Secondary	50	50	0	0	0	0
Total Impacts CM2–CM18		**76**	**77**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**76**	**77**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

Alternative 1B conservation measures would result in the total loss or conversion of up to 35 acres of modeled clapper rail habitat consisting of 27 acres of primary habitat and 50 acres of secondary habitat (Table 12-1B-26). The conservation measure that would result in these losses is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would convert approximately 77 acres of modeled California clapper rail habitat (27 acres of primary habitat, 50 acres of secondary habitat), the majority of which would occur in CZ 11. The tidal marsh restoration action would not result in the permanent loss of any California clapper rail habitat in the study area. However, approximately 27 acres of primary habitat would be converted to secondary low marsh habitat and 50 acres of secondary habitat would be converted to middle or high marsh. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11. Tidal wetlands would be restored as a mosaic of large, interconnected, and biologically diverse patches that supported a natural gradient extending from subtidal to the upland fringe. Much of the restored tidal brackish emergent wetland would meet the primary habitat requirements of the California clapper rail, including development of mid- and high-marsh vegetation with dense, tall stands of pickleweed cover. Restoration would be sequenced and spaced in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.

- *CM11 Natural Communities Enhancement and Management*: Because the entire California clapper rail population is restricted to the San Francisco Bay Area estuary, BDCP enhancement and restoration actions would be expected to benefit the species by creating the potential for extending its abundance and distribution in Suisun Marsh. Occupied California clapper rail habitat would be monitored to determine if there is a need for predator control actions. If implemented, nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats could result in localized ground disturbances that could temporarily remove small amounts of California clapper rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available California clapper rail habitat. These potential effects are currently not quantifiable, but would be minimized with implementation *AMM19 California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect California clapper rail use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, and habitat restoration, enhancement, and management could result in injury or mortality of California clapper rail. Operation of construction equipment could result in injury or mortality of California clapper rails. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is less likely as these individuals are expected to avoid contact with construction equipment. However, nest sites would be avoided during the nesting season as required by AMM1–AMM7 and *AMM19 California Clapper Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to compensate for the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4). These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 50 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and at least 1,500 acres of the restored marsh would consist of middle-and high-marsh vegetation, serving as primary habitat for California clapper rail in Suisun Marsh (Objectives TBEWNC1.1 and TBEWNC1.2). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, *Effects Analysis*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of California clapper rail habitat associated with Alternative 1B would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*, which would be in place throughout the construction period, the effects of Alternative 1B as a whole on California clapper rail would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term from the implementation of *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the study area. These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that

creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4).

These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of restoration impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM19 California Clapper Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 76 acres of restored tidal natural communities, the 2,000 acres of tidal brackish emergent wetland restoration contained in the near-term Plan goals, and the additional detail in the biological objectives for California clapper rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 8 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed, serving as primary habitat for clapper rail in Suisun Marsh (Objective TBEWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California clapper rail.

Impact BIO-63: Indirect Effects of Plan Implementation on California Clapper Rail

Indirect Construction-Related Effects: California clapper rail habitat within the vicinity of proposed restoration areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California clapper rail. The use of mechanical equipment during construction-related restoration activities could cause the accidental release of petroleum or other contaminants that could affect clapper rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM19 California Clapper Rail* that preconstruction surveys of potential breeding habitat would be conducted within 500 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Preconstruction surveys conducted under *AMM19 California Clapper Rail* would ensure construction-related noise and visual disturbances would not have an adverse effect on California clapper rail. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and ensure measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Therefore, with the implementation of AMM1–AMM7 and *AMM19 California Clapper Rail*, there would be no adverse effect on California clapper rail.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which would be beneficial to California clapper rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rails are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on California clapper rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the California clapper rail. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California clapper rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California clapper rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California clapper rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. Potential

effects of noise and visual disturbances on California clapper rail would be minimized with *AMM19 California Clapper Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions. Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration Actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, changes in salinity, and increased exposure to selenium from Alternative 1B implementation would not have an adverse effect on California clapper rail.

***CEQA Conclusion*:** Noise and visual disturbances related to construction-related activities from the conservation measures could disturb California clapper rail habitat adjacent to work sites. *AMM19 California Clapper Rail* would avoid and minimize impacts on California clapper rail from noise and visual disturbance. The use of mechanical equipment during restoration activities or the inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. These impacts on California clapper rail would be less than significant with the incorporation of AMM1–AMM7 into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California clapper rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration Actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the study area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to 3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects**:** The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion**:** The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to movements of California clapper rail. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and, thus, temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California clapper rail or restoration activities resulting in barriers to movement would be minimized through sequencing of restoration activities to minimize effects of temporary habitat loss. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California clapper rail as a result of special-status species habitat modification because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California clapper rail as a result of habitat modification of a special status species because Tidal Natural Communities Restoration (CM4) would be phased to allow for the recovery of some areas before initiating restoration actions in other areas. In addition, In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

California Least Tern

This section describe the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of California least tern modeled habitat as indicated in Table 12-1B-27. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit California least tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect at least 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the at least 65,000 acres of tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation).

As explained below, with the restoration and protection of tidal perennial aquatic foraging habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and mitigation to avoid impacts on terns should they nest in the study area, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-27. Changes in California Least Tern Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Foraging	33	33	145	145	NA	NA
Total Impacts CM1		**33**	**33**	**145**	**145**	**NA**	**NA**
CM2–CM18	Foraging	38	46	11	16	NA	NA
Total Impacts CM2–CM18		**38**	**46**	**11**	**16**	**NA**	**NA**
TOTAL IMPACTS		**71**	**79**	**156**	**161**	**NA**	**NA**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 215 acres of modeled foraging habitat for California least tern (Table 12-1B-27). The conservation measures that would result in these losses are construction of water conveyance facilities and operation (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 178 acres of modeled California least tern aquatic foraging habitat (Table 12-1B-27). Of the 178 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 145 acres would be a temporary loss. Most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The temporary effects on California least tern habitat would occur at numerous locations, including in the Sacramento River at Intakes 1–5, and at temporary siphon construction work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough and Middle River just southeast of Victoria Canal. Tunnel work areas and transmission construction sites at the junction of the new canal and the new Byron Court Forebay would also temporarily affect foraging habitat in West Canal, Grant Line Canal and Old River just south of Clifton Court

Forebay. The CM1 footprint does not overlap with any California least tern occurrences. However, Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, (described below) would be available to minimize potential effects on terns if they were to nest in or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. These losses would take place during the first 10 years of Alternative 1B implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancement would result in the permanent loss of 8 acres and the temporary loss of 11 acres of modeled aquatic foraging habitat for California least tern in CZ 2. The loss would be expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration actions would result in the permanent loss of 36 acres of modeled aquatic foraging habitat for California least tern. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic would be restored, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration is consistent with BDCP Objective TPANC1.1. Tidal perennial aquatic restoration would be expected to substantially increase the primary productivity of fish, increasing the prey base for California least tern. Approximately 3,400 acres of the restoration would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be phased over the following 30 years. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would result in the permanent loss of 2 acres and the temporary loss of 5 acres of modeled aquatic foraging habitat for California least tern. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers.

- *CM11 Natural Communities Enhancement and Management*: Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and injury mortality and noise and visual disturbance of nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic post construction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the BDCP. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs described below.

Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in Suisun Marsh and west Delta area (CZ 10 and CZ 11). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or mortality would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraphs summarize the combined effects discussed above, describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions area also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1B implementation, there would be a loss of 227 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 178 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4]—49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 178 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3).This conservation action would result in the creation of approximately 3,400 acres of high quality tidal perennial aquatic natural community, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The California least tern is not a species that is covered under the BDCP. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this effect on nesting California least terns.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 240 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* would restore an estimated 27,000 acres of high quality tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1B would represent an adverse effect in the absence of other conservation actions. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would be available to address this effect on nesting California least terns. With habitat restoration associated with CM4 and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*, which would be in place throughout the construction period, the effects of Alternative 1B as a whole on California least tern would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1B implementation, there would be a loss of 227 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 178 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 178 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3). Modeling conducted by ESA PWA indicates that this conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will Be Minimized*, would reduce the impact on nesting California least terns to a less-than-significant level.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, AMM1–AMM7 and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on*

Colonies Will Be Minimized, would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 227 acres of restored tidal perennial aquatic habitat, the 3,400 acres of tidal perennial aquatic restoration estimated in the near-term, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 240 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore an estimated 27,000 acres of high-value tidal perennial aquatic natural community (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

In the absence of other conservation actions, the loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1B would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1B would represent a significant impact in the absence of other conservation actions. However, with habitat restoration associated with CM4 and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, which would be in place throughout the construction period, and the implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, the loss of habitat or mortality under this alternative would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat is identified during planning level surveys), at least three preconstruction surveys for this species will be conducted during the nesting season by a qualified biologist with experience observing the species and its nests. Projects will be designed to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of Plan Implementation on California Least Tern

Indirect Construction- and Operation-Related Effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and large mouth bass tissues were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in BDCP Appendix 5.D, *Contaminants*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). The potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level.

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to

Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects**:** Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would be available to address this effect. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion**:** Noise and visual disturbances within 500 feet of construction-related activities could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM12, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of mortality of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would substantially reduce the potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater*

Sandhill Crane, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes “roosting and foraging” and “foraging” habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (BDCP Appendix 2.A, *Covered Species Accounts*).

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-1B-28. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).
- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and

local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, AMM20 *Greater Sandhill Crane*, *AMM27 Selenium Management*, *AMM30 Transmission Line Design and Alignment Guidelines*, and Mitigation Measures BIO-69a and BIO-69b, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-28. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Roosting and Foraging - Permanent	0	0	0	0	NA	NA
	Roosting and Foraging - Temporary	148	148	733	733		
	Foraging	3,265	3,265	4,632	4,632	NA	NA
Total Impacts CM1		**3,413**	**3,413**	**5,365**	**5,365**		
CM2–CM10	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	2,776	4,367	0	0	0	0
Total Impacts CM2–CM18		**2,776**	**4,408**	**0**	**0**	**0**	**0**
Total Roosting and Foraging		**148**	**189**	**733**	**733**	**0**	**0**
Total Foraging		**6,041**	**7,632**	**4,632**	**4,632**	**0**	**0**
TOTAL IMPACTS		**6,189**	**7,821**	**5,365**	**5,365**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 922 acres of temporary roosting and foraging habitat (189 acres of permanent loss, 733 acres of temporary loss) and 12,264 acres of foraging habitat for greater sandhill crane (7,632 acres of permanent loss, 4,632 acres of temporary loss, Table 12-1B-28). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas from *CM1 Water Facilities and Operation*, *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM10 Nontidal Marsh Restoration, and CM11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from conversion to tidal natural communities through CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities as they are currently designed would result in the combined permanent and temporary loss of up to 8,778 acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 148 acres of roosting and foraging habitat, and 3,771 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 949 acres of very high-value, 566 acres of high-value, and 789 acres of medium-value foraging habitat (Table 12-1B-29). In addition, 733 acres of temporary roosting and foraging habitat and 4,632 acres of foraging habitat would be temporarily removed (Table 12-1B-28). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. CM1 activities that would result in temporary impacts would include temporary access roads, borrow and spoil sites, and work areas for construction.

  The temporary roost sites that would be permanently impacted are located on Zaccharias Island, Shin Kee Tract, and Ringe Tract and impacts would occur from the construction of the canal and the proposed permanent transmission line footprint. Temporary impacts on temporary roosting and foraging habitat would occur from temporary work areas associated with the construction of the canal and borrow and spoil areas. Approximately 642 acres of temporary impact on temporary roosting and foraging sites would occur from the footprint of the borrow and spoil areas associated with the construction of the canal. Indirect effects of construction of the canal adjacent to Stone Lakes National Wildlife Refuge could result in the abandonment of roost sites adjacent to the CM1 footprint. Indirect effects of noise and visual disturbance are addressed under Impact BIO-71.

  The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands. Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane*, in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

  Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would be adverse in the absence of other conservation measures. The proposed permanent transmission line alignment would occur east of The potential for injury and direct mortality from electrical transmission facilities is addressed below under Impact BIO-70. The transmission line alignment under Alternative 1B is not fully designed and the final transmission line design would be determined in coordination with USFWS, CDFW, and a qualified crane biologist to achieve a performance standard of no net increase in bird strike hazard to greater sandhill cranes in the Plan Area (*AMM20 Greater Sandhill Crane*). Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days* *on Bract Tract*, would be available to address the effects of construction activities on or adjacent to Bract Tract.

Permanent and temporary impacts on foraging habitat would occur throughout the Delta from the construction of Intakes 1-5, construction of the canal, and associated borrow and spoil and RTM storage areas along the canal alignment. Approximately 3,479 acres of temporary impact on foraging habitat would result from the footprint of the borrow and spoil areas associated with the construction of the intakes and the canal. Approximately 223 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1B-29. Total Amount of Affected Greater Sandhill Crane Foraging Habitat

Foraging Habitat Value Class	Land Cover Type	Acres Affected by CM1 permanent [temporary]] (acres)	Acres Affected by CM2–CM18 permanent (temporary) acres
Very high	Corn, rice	949 (1,845)	1,155 (0)
High	Wheat, managed wetlands,	0 (2)	489 (0)
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	1,027 (1,487)	1,403 (0)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	1,288 (1,298)	1,320 (0)
Total		**3,265 (4,632)**	**4,367**

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 2,754 acres of greater sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 2,713 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 716 acres of very high-value, 304 acres of high value, 873acres of medium-value, and 821 acres of low-value foraging habitat This loss would occur in the Cosumnes-Mokelumne River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. In CZ 5, loss of modeled habitat would occur along the western edge of the greater sandhill crane winter use area and therefore would not result in fragmentation of traditional crane habitats. Therefore fragmentation of habitat from tidal restoration activities would be expected to be minimal. Approximately 1,951 acres of foraging habitat would be impacted within the first 10 years of Plan implementation.

- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands that provide foraging habitat for greater sandhill crane would be converted to grassland by the late long-term timeframe. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the greater sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Plan implementation.

- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the greater sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Plan implementation.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, greater sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of plan implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, effects of operations and maintenance on sandhill cranes would be reduced by AMMs, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. The potential for injury and direct mortality from electrical transmission facilities is discussed below under Impact BIO-70.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 881 acres roosting and foraging habitat (148 acres of permanent loss, 733 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 10,673 acres of foraging habitat would be removed or converted in the near-term (CM1, 7,897 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 7,245 acres would be moderate- to very high-value habitat (CM1, 5,310 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 881 acres of greater roosting habitat should be restored/created and 881 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 5,310 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 881 acres of roosting and foraging habitat once the project design was final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*. Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would be adverse in the absence of other conservation measures. Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract* would be available to address the effects of construction activities on or adjacent to Bract Tract.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to construction. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a, *Compensate for the Loss of Medium- to Very High-Value Greater Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 922 acres of roosting and foraging habitat (4% of the total habitat in the study area) and 12,264 acres of foraging habitat (7% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 8,357 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres and could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives

GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Mitigation-Measure BIO-69a would be available to ensure that the loss of 9,219 acres of moderate- to very high-value crop types was compensated for with sufficient acres of high- to very high-value crop types by the late long-term timeframe. Mitigation Measure BIO-69b would be available to reduce effects from CM1 activities on or adjacent to Bract Tract.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering habitat protection, restoration, management, and enhancement would be guided by performance standards, and the aforementioned AMMs, which would be in place throughout the period of construction, greater sandhill crane habitat losses and conversions under Alternative 1B would not be an adverse effect under NEPA in the late long-term.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 881 acres roosting and foraging habitat (148 acres of permanent loss, 733 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 10,673 acres of foraging habitat would be removed or converted in the near-term (CM1, 7,897 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 7,245 acres would be moderate- to very high-value habitat (CM1, 5,310 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 881 acres of greater roosting habitat should be restored/created and 881 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 5,310 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and

CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 881 acres of roosting and foraging habitat once the project design was final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*. Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would be a significant impact in the absence of other conservation measures. Implementation of Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract,* would reduce the impact of construction activities on or adjacent to Bract Tract to a less-than-significant level.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses. Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres, could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to construction. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 922 acres of roosting and foraging habitat (4% of the total habitat in the study area) and 12,264 acres of foraging habitat (7% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 8,357 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures.

The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres and could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with

consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Mitigation-Measure BIO-69a would be available to ensure that the loss of 9,219 acres of moderate- to very high-value crop types was compensated for with sufficient acres of high- to very high-value crop types by the late long-term timeframe.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 1B would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Considering Alternative 1B's protection and restoration provisions, in addition to Mitigation Measure BIO-69a, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, and Mitigation Measure BIO-69b, which would require no loss of crane use on Bract Tract habitat, habitat loss and direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on greater sandhill crane.

Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat

DWR will compensate for the loss of greater sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent within the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging habitat value categories are listed in Table 12-1B-29. Foraging habitat conservation must occur within the greater sandhill crane winter use area and the location of protected habitat or conservation easements must be preapproved by USFWS and CDFW.

Mitigation Measure BIO-69b: BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract

Because of the density of greater sandhill cranes wintering on and adjacent to Bract Tract and the importance of Staten Island to the sustainability of the greater sandhill crane population in the Plan Area, DWR will minimize, to the extent practicable, the final placement of conveyance facilities on Bract Tract. BDCP-related construction shall not result in a net decrease in crane use on Bract Tract as determined by deriving greater sandhill crane use days for the entire winter period (see *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, for a description of how loss of crane use will be estimated). This standard shall be achieved through some combination of the following (and including the avoidance and minimization measures for CM1 required under *AMM20 Greater Sandhill Crane*).

- Minimize and/or shift the footprint of activities on Bract Tract
- Minimize noise, lighting, and visual disturbances during construction
- Minimize construction activity during the crane wintering season to the extent practicable
- Supplemental feeding/foraging habitat enhancement: The enhanced habitat will consist of corn fields that will not be harvested, and will be managed to maximize food availability to greater sandhill cranes. A management plan for the enhanced habitat will be completed prior to establishing the habitat, in coordination with a qualified crane biologist (with at least 5 years of experience managing greater sandhill crane habitat on cultivated lands, or experience directing such management). The enhanced habitat will be located outside the construction related 50 dBA L_{eq} (1 hour) noise contour and within 1 mile of the affected habitat.
- Maintain flooding and irrigation capacity. Stage CM1 activities on Bract Tract such that they do not disrupt flooding and irrigation to the extent that greater sandhill crane habitat will be reduced during the crane wintering season.

Prior to construction on Bract Tract, a qualified, wildlife agency approved crane biologist will coordinate with DWR to develop a strategy for achieving the Bract Tract performance standard (no net decrease in crane use on Bract Tract) using a combination of the measures described above, and prepare a plan based on the final construction design on Bract Tract that includes all conservation measures necessary for achieving the performance standard. This plan will be subject to review and approval by the USFWS and CDFW prior to its implementation. All conservation measures will be in place, consistent with the plan, prior to project construction on or adjacent to Bract Tract.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 1B facilities as described below. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions.

The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1B was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Typically, higher-voltage (230-kilovolt [kV]) lines vary in height from 90 to 110 feet, while “sub” transmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1B alignment would require the installation of approximately 53 miles of permanent transmission line (16 miles of 230-kV lines and 37 miles of 69-kV lines) extending north and south, through much of the crane use area. The temporary transmission lines would total approximately 47 miles (14 miles of 69-kV line and 33 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years. The proposed permanent and temporary transmission lines that would be constructed through Bract Tract as they are currently designed would have the potential to substantially affect greater sandhill cranes as this is a high-use area for cranes in the Delta.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1B meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters will be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing mortality in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1B is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1B would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1B is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1B would would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of Plan Implementation on Greater Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 1B and to determine that as much as much as 7,746–17,967 acres of crane habitat could be affected by general construction noise above baseline level (50–60 dBA). This would include 109–576 acres of permanent crane roosting habitat, 904–2,078 acres of temporary crane roosting habitat, and 6,733–15,314 acres of crane foraging habitat. In addition, 252–950 acres of permanent crane roosting habitat, 471–1,623 acres of temporary crane roosting habitat, and 1,623–18,043 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-1B-30). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-1B-30. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 1B (acres)

	General Construction		Pile Driving	
Habitat Type	Above 60 dBA	Above 50 dBA	Above 60 dBA	Above 50 dBA
Permanent Roosting	109	576	252	950
Temporary Roosting	904	2,078	471	1,623
Foraging	6,733	15,314	1,623	18,043
Total Habitat	**7,746**	**17,967**	**2,347**	**20,616**

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities would not be expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on greater sandhill crane. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Therefore, potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect greater sandhill crane via uptake in lower trophic levels (see Appendix 5.D, *Contaminants*, of the BDCP). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Crane foraging habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate impacts on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in greater sandhill cranes would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1B would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on greater sandhill crane.

Lesser Sandhill Crane

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. These habitat types include suitable foraging and roosting habitat in the study area as certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser Sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.). The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-1B-31. Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP for the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*) that would also benefit the lesser sandhill crane.

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).

- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).

- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).

- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, AMM30 *Transmission Line Design and Alignment Guidelines*, and Mitigation Measures BIO-72 and BIO-69b, impacts on the lesser sandhill crane would be less than significant for CEQA purposes.

Table 12-1B-31. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Roosting and Foraging – Permanent	0	0	0	0	NA	NA
	Roosting and Foraging – Temporary	148	148	733	733	NA	NA
	Foraging	4,002	4,002	6,806	6,806	NA	NA
Total Impacts CM1		**4,150**	**4,150**	**7,539**	**7,539**	**NA**	**NA**
CM2–CM18	Roosting and Foraging – Permanent	0	0	0	0	0	0
	Roosting and Foraging – Temporary	0	41	0	0	0	0
	Foraging	3,610	12,131	0	0	0	0
Total Impacts CM2–CM18		**3,610**	**12,172**	**0**	**0**	**0**	**0**
Roosting and Foraging - Permanent		**0**	**0**	**0**	**0**	**0**	**0**
Roosting and Foraging - Temporary		**148**	**189**	**733**	**733**	**0**	**0**
Foraging		**7,612**	**16,133**	**6,806**	**6,806**	**0**	**0**
TOTAL IMPACTS		**7,760**	**16,322**	**7,539**	**7,539**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

[e] Restored/created and protected habitat acreages represent planned conservation activities that would be implemented over the lifetime of the BDCP (see BDCP Chapter 3, *Conservation Strategy*, for specifics).

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 922 acres of modeled roosting and foraging habitat (189 acres of permanent loss and 733 acres of temporary loss) and 19,892 acres of foraging habitat (15,372 acres of permanent loss and 4,520 acres of temporary loss) for lesser sandhill crane (Table 12-1B-31). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Improvements (CM2), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities as they are currently designed would result in the combined permanent and temporary loss of up to 10,808 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 148 acres of roosting and foraging habitat, and 4,002 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 2,001 acres of very high-value, 157 acres of high-value, and 789 acres of medium-value foraging habitat (Table 12-1B-32). In addition, 733 acres of temporary roosting and foraging habitat and 6,806 acres of foraging habitat would be temporarily removed (Table 12-1B-31). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. CM1 activities that would result in temporary impacts would include temporary access roads, borrow and spoil sites, and work areas for construction.

  The temporary roost sites that would be permanently impacted are located on Zaccharias Island, Shin Kee Tract, and Ringe Tract and impacts would occur from the construction of the canal and the proposed permanent transmission line footprint. Temporary impacts on temporary roosting and foraging habitat would occur from temporary work areas associated with the construction of the canal and borrow and spoil areas. Approximately 642 acres of temporary impact on temporary roosting and foraging sites would occur from the footprint of the borrow and spoil areas associated with the construction of the canal. Indirect effects of construction of the canal adjacent to Stone Lakes National Wildlife Refuge could result in the abandonment of roost sites adjacent to the CM1 footprint. Indirect effects of noise and visual disturbance are addressed under Impact BIO-71.

  The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands. Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would have an adverse effect in the absence of other conservation measures. The potential for injury and direct mortality from electrical transmission facilities is addressed below under Impact BIO-70. The transmission line alignment under Alternative 1B is not fully designed and the final transmission line design would be determined in coordination with USFWS, CDFW, and a qualified crane biologist to achieve a performance standard of no net increase in bird strike hazard to greater sandhill cranes in the Plan Area (*AMM20 Greater Sandhill Crane*). Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract* would be available to address the effects of construction activities on or adjacent to Bract Tract on greater sandhill cranes. Measures to meet the performance standards of no net increase in bird strike hazard to greater sandhill cranes in the Plan Area and no net decrease in crane use days on Bract Tract would also reduce effects on lesser sandhill cranes.

Permanent and temporary impacts on foraging habitat would occur throughout the Delta from the construction of Intakes 1-5, construction of the canal, and associated borrow and spoil and RTM storage areas along the canal alignment. Approximately 5,456 acres of temporary impact on foraging habitat would result from the footprint of the borrow and spoil areas associated with the construction of the intakes and the canal. Approximately 223 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1B-32. Total Amount of Affected Lesser Sandhill Crane Foraging Habitat

Foraging Habitat Value Class	Land Cover Type	CM1 Permanent (Temporary)	CM2–CM18 Permanent (Temporary)
Very high	Corn, alfalfa and alfalfa mixtures	2,001 (4,497)	4,083 (0)
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	157 (186)	2,058 (0)
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, non-irrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	789 (659)	2,220 (2)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	969 (1,421)	3,745 (2)
None	Vineyards, orchards	85 (43)	23 (0)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction under CM2 would result in a permanent loss of 267 acres and a temporary loss of 2 acres of lesser sandhill crane foraging habitat in CZ 2. Lesser sandhill crane use in this area is less common than in the central Delta. Construction impacts from CM2 would occur within the first 10 years of Plan implementation.
- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 10,248 acres of lesser sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 10,207 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 3,642 acres of very high-value, 1,529 acres of high value, 2,040 acres of medium-value, and 2,983 acres of low-value foraging habitat (Table 12-1B-32). Habitat loss would primarily occur in the Cosumnes-Mokelumne River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. Lesser sandhill cranes are less traditional than greater sandhill cranes and would be more adaptable to changes in land use. Approximately 2,516 acres of foraging habitat would be removed within the first 10 years of Plan implementation.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees would result in the loss of 2 acres of low-value lesser sandhill crane foraging habitat (1 acre of permanent loss, 1 acres of temporary loss). This impact would occur after the first 10 years of Plan implementation.
- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands (foraging habitat) would be converted to grassland. No roosting/foraging habitat would be

impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the lesser sandhill crane. Approximately 257 acres would be impacted within the first 10 years of plan implementation.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the lesser sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Plan implementation.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of plan implementation).
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by AMMs, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. Injury and mortality from electrical transmission facilities are described below under Impact BIO-73.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 881 acres roosting and foraging habitat (148 acres of permanent loss, 733 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 14,420 acres of foraging habitat would be removed or converted in the near-term (CM1, 10,807 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impact, 10,795 acres would be moderate- to very high-value habitat (CM1, 8,289 acres, CM4-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 881 acres of lesser sandhill crane roosting habitat should be restored/created and 881 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 8,289 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 881 acres of roosting and foraging habitat once the project design is final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*. Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would be adverse in the absence of other conservation measures. Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract* would be available to address the potential effects of construction activities on or adjacent to Bract Tract.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72, *Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 952 acres of roosting and foraging habitat (4% of the total habitat in the study area) and 22,940 acres of foraging habitat (10% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 16,652 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane. Mitigation-Measure BIO-72 would be available to ensure that the loss of 16,652 acres of moderate- to very high-value crop types was compensated for with sufficient acres of high- to very high-value crop types by the late long-term timeframe. Mitigation Measure BIO-69b would be available to reduce adverse effects from CM1 activities on or adjacent to Bract Tract.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat and potential for direct mortality of this special status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration*, guided by biological goals and objectives for the species and by AMM1–AMM7 and *AMM20 Greater Sandhill Crane*, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-69b and Mitigation Measure BIO-72, which would be available to compensate for loss of medium- to very high-value foraging habitat, the effects of habitat loss and potential mortality on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 881 acres roosting and foraging habitat (148 acres of permanent loss, 733 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 14,420 acres of foraging habitat would be removed or converted in the near-term (CM1, 10,807 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impact, 10,795 acres would be moderate- to very high-value habitat (CM1, 8,289 acres, CM4-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 881 acres of lesser sandhill crane roosting habitat should be restored/created and 881 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 8,289 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 881 acres of roosting and foraging habitat once the project design is final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*. Traditional roosting and foraging sites on Bract Tract (east of Staten Island) are among the highest crane use areas in the Delta. Impacts on Bract Tract include the construction of the canal, proposed permanent and temporary transmission lines, potential borrow and spoil areas, and temporary work areas. Construction within or adjacent to this important crane use area would be adverse in the absence of other conservation measures. Implementation of Mitigation Measure BIO-69b, *BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract,* (see Impact BIO-69) would address the impact of construction activities on or adjacent to Bract Tract.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72 would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 952 acres of roosting and foraging habitat (4% of the total habitat in the study area) and 22,940 acres of foraging habitat (10% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 16,652 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane. Mitigation-Measure BIO-72 would be available to ensure that the loss of 16,652 acres of moderate- to very high-value crop types was compensated for with sufficient acres of high- to very high-value crop types by the late long-term timeframe. Implementation of Mitigation Measure BIO-69b would reduce impacts resulting from CM1 activities on or adjacent to Bract Tract to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1B's protection and restoration provisions, in addition to Mitigation Measure BIO-69b, which would reduce significant impacts from CM1 activities on Bract Tract, and Mitigation Measure BIO-72, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on lesser sandhill crane.

Mitigation Measure BIO-69b: BDCP-Related Construction Will Not Result in a Net Decrease in Crane Use Days on Bract Tract

See description of Mitigation Measure BIO-69b under Impact BIO-69.

Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

DWR must compensate for the loss of lesser sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging value categories are listed in Table 12-1B-32. Foraging habitat conservation must occur within 10 kilometers of traditional sandhill crane roost sites and the location of protected habitat or conservation easements must be preapproved by CDFW.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 1B facilities as described below. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1B was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

Typically, higher-voltage (230-kilovolt [kV]) lines vary in height from 90 to 110 feet, while “sub” transmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1B alignment would require the installation of approximately 53 miles of permanent transmission line (16 miles of 230-kV lines and 37 miles of 69-kV lines) extending north and south, through much of the crane use area. The temporary transmission lines would total approximately 47 miles (14 miles of 69-kV line and 33 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years. The proposed permanent and temporary transmission lines that would be constructed through Bract Tract as they are currently designed would have the potential to substantially affect lesser sandhill cranes as this is a high-use area for cranes in the Delta.

After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1B meets the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for lesser sandhill crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters will be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

***NEPA Effects*:**

Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1B is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit the lesser sandhill crane. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1B would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1B is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit lesser sandhill crane. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1B would would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of Plan Implementation on Lesser Sandhill Crane

Indirect Construction-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 1B and to determine that as much as much as 7,746-17,967 acres of crane habitat could be affected by general construction noise above baseline level (50–60 dBA). This would include 109 – 576 acres of permanent crane roosting habitat, 904 – 2,078 acres of temporary crane roosting habitat, and 6,733 – 15,314 acres of crane foraging habitat. In addition, 252 - 950 acres of permanent crane roosting habitat, 471 – 1,623 acres of temporary crane roosting habitat, and 1,623 – 18,043 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-1B-32, see Impact BIO-71). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure:

Covered activities have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on lesser sandhill crane as they primarily forage on cultivated crops and invertebrates. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect lesser sandhill crane via uptake in lower trophic levels (see BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane foraging habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane*, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate for affected habitat. Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Crane foraging habitat could be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators.

Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat, there would not be an adverse effect on lesser sandhill crane.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of A*MM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in lesser sandhill crane would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on lesser sandhill crane.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1B would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on the least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-1B-33. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit least Bell's vireo and yellow warbler (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).

- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM7).
- Maintain and enhance structural heterogeneity (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation (Objective VFRNC2.2, associated with CM7).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-33. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Migratory and Breeding	24	24	30	30	NA	NA
Total Impacts CM1		**24**	**24**	**30**	**30**	**NA**	**NA**
CM2–CM18	Migratory and Breeding	382	656	88	109	48–85	148
Total Impacts CM2–CM18		**382**	**656**	**88**	**109**	**48–85**	**148**
TOTAL IMPACTS		**406**	**680**	**118**	**139**	**48–85**	**148**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 819 acres of modeled habitat (680 acres of permanent loss and 139 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-1B-33). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 54 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-1B-33). Of the 54 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 24 acres would be a permanent loss and 30 acres would be a temporary loss of habitat. The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. A small area of riparian habitat (mostly blackberries) would be permanently removed in the south Delta at the new forebay construction site. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal. Tunnel construction at Old River just south of Victoria Canal would also temporarily remove mixed willows and brambles. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least four years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancements (CM2) would permanently remove approximately 83 acres and temporarily remove 88 acres of modeled least Bell's vireo and yellow warbler habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1B implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled least Bell's vireo and yellow warbler habitat.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 28 acres and temporarily remove 21 acres of modeled least Bell's vireo and yellow warbler habitat. Based on the riparian habitat restoration assumptions, a minimum of 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions.

  The actual number of acres of valley/foothill riparian habitat that CM4 and CM5 would restore may differ from these estimates, depending on how closely the actual outcome of tidal habitat restoration approximates the assumed outcome. However, riparian restoration from CM4 and CM5 would increase the extent of least Bell's vireo and yellow warbler habitat within the Plan Area once the restored riparian vegetation has developed habitat functions for these species.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat over the term of the BDCP. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the Plan Area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the Plan Area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbance that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Although least Bell's vireo nesting has not been confirmed in the Plan Area, recent occurrences in the Yolo Bypass and at the San Joaquin River National Wildlife Refuge suggest that the reestablishment of a breeding population is a possibility over the duration of the BDCP. If present in the study area, construction -related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 524 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 54 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 54 acres of valley/foothill riparian habitat should be restored/created and 54 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests were detected and avoided. Mitigation Measure BIO-75 would be available to address adverse effects on nesting yellow warblers.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 819 acres of habitat for these species during the term of the Plan (6% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo, and the effect of habitat loss on yellow warbler would not be adverse under Alternative 1B. The yellow warbler is not a species that is covered under the BDCP and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. The Plan would remove 524 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 54 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements

[CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 54 acres of valley/foothill riparian habitat should be restored/created and 54 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the Plan Area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting yellow warblers to a less-than-significant impact, should they become established in the Plan Area. Considering the conservation actions described above, and AMM1–AMM7, AMM 22, and Mitigation Measure BIO-75, Alternative 1B over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 1B would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 819 acres of habitat for these species during the term of the Plan (6% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Therefore, there would be a time-lag before the restored habitat would benefit either species. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area, and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily*

Affected Natural Communities, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all construction activities, the effects of habitat loss and potential mortality on least Bell's vireo under Alternative 1B would be less than significant. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect nesting yellow warblers, in order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting yellow warblers, if present in the study area, to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.
- A qualified wildlife biologists with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors and species of special concern (except the Modesto song sparrow), and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or birds protect by the MBTA. If no active nests are detected during these surveys, no additional measures are required.
- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects: Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 1B would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*, of the BDCP). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that the transmission lines, poles, and towers are designed to avoid sensitive terrestrial habitats (including riparian) to the maximum extent feasible, which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which will minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of Plan Implementation on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least Bell's vireo and yellow warbler.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least Bell's vireo and yellow warbler from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see

Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on nesting yellow warblers.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential effects of methylmercury on least Bell's vireo and yellow warbler.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on least Bell's vireo and yellow warbler with the implementation of *AMM2 Construction Best Management Practices and Monitoring*, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Sites-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-85 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 2. No adverse effects of increased inundation frequency on least Bell's vireo, yellow warbler, or their habitat would be expected, because riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in periodic inundation of up to 148 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 7. Inundation of restored floodplains would not be expected to affect least Bell's vireo, yellow warbler, or their habitat because the breeding period is outside the period when floodplains would likely be inundated. Additionally, periodic inundation of floodplains would be expected to restore a more natural flood regime in support of riparian vegetation types that support least Bell's vireo and yellow warbler habitat. The overall effect of seasonal inundation in existing riparian natural communities would be beneficial, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would not result in an adverse effect on least Bell's vireo or yellow warbler because inundation would occur primarily during the nonbreeding season and would promote a more natural flood regime in support of habitat for these species.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would have a less-than-significant impact on least Bell's vireo or yellow warbler because inundation would occur during the nonbreeding season and would not be expected to adversely modify habitat or result in direct mortality of either species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation in existing riparian natural communities would be beneficial for least Bell's vireo and yellow warbler.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 1B on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects for these species is based on primary breeding habitat and secondary habitat. Suisun song sparrow primary breeding habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the Plan Area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable forage. Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-1B-34. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the Suisun song sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3)
- Protect at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3)

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on Suisun song sparrow and saltmarsh common yellowthroat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-34. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	54	55	0	0	0	0
	Secondary	1,098	3,633	0	0	0	0
Total Impacts CM2–CM18		**1,152**	**3,688**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,152**	**3,688**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Alternative 1B conservation measures would result in the permanent loss of up to 3,688 acres of Suisun song sparrow and saltmarsh common yellowthroat habitat, which would include the conversion of 55 acres of primary habitat to secondary low marsh, and the conversion of 123 acres of secondary habitat to middle or high marsh (Table 12-1B-34). The only conservation measure that would affect modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would permanently remove approximately 3,510 acres of modeled secondary Suisun song sparrow and saltmarsh common yellowthroat habitat from CZ 11 (Table 12-1B-34). In addition, 55 acres of primary habitat would be converted to secondary low marsh, and 123 acres of secondary habitat would be converted to middle or high marsh. Most areas proposed for removal would be managed wetlands that serve as relatively marginal habitat for Suisun song sparrow and saltmarsh common yellowthroat, which primarily use brackish tidal wetlands. Approximately 2% of primary habitat for these species would be converted to foraging habitat. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland natural community in CZ 11, which would be expected to support Suisun song sparrow and saltmarsh common yellowthroat habitat. It is expected that restoring tidal wetland communities that are self-sustaining and not reliant on ongoing management actions necessary to maintain the existing managed wetland habitats would better ensure the long-term viability of these populations. Furthermore, effects of tidal habitat restoration on sparrow and yellowthroat abundance and distribution would be monitored, and the restoration of tidal habitat would be sequenced and located in a manner that minimizes effects on occupied habitats until functional habitats were restored (see BDCP Chapter 3, Section 3.4.4, *Conservation Measure 4 Tidal Natural Communities Restoration*, and Section 3.6, *Adaptive Management and Monitoring Program*).

- *CM11 Natural Communities Enhancement and Management:* Control of nonnative Suisun song sparrow and saltmarsh common yellowthroat predators, if deemed necessary, would be expected to reduce predation loss of nests and, consequently, increase and maintain the abundance of Suisun song sparrow and saltmarsh common yellowthroat in restored tidal habitats over the term of the BDCP. Habitat management- and enhancement-related activities could disturb Suisun song sparrow or saltmarsh common yellowthroat nests if they are located near work sites. The potential for these activities to have an adverse effect on Suisun song sparrow would be avoided and minimized through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. A variety of *CM11 Natural Communities Enhancement and Management* habitat management actions that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of Suisun song sparrow and saltmarsh common yellowthroat habitat in CZ 11. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available species' habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect Suisun song sparrow and saltmarsh common yellowthroat use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Construction-related activities could result in nest destruction or disturbance resulting in mortality of eggs and nestlings if restoration activities took place within the nesting period for these species. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize these potential effects on Suisun song sparrow. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. Grading, filling, contouring, and other initial ground-disturbing operations during restoration activities could temporarily fragment existing modeled tidal brackish emergent wetland habitat for Suisun song sparrow and saltmarsh common yellowthroat which could temporarily reduce the extent and functions of the affected habitat. These temporary effects would be minimized through sequencing of restoration activities and through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are included.

Near-Term Timeframe

Under Alternative 1B, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,152 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to compensate for the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the study area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the effect of construction activities on nesting saltmarsh common yellowthroat.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1B as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of Suisun song sparrow and saltmarsh common yellowthroat habitat and potential direct mortality of these special status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and the incorporation of the additional measures in the biological goals and objectives, AMMs1–7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality under Alternative 1B on Suisun song sparrow would not be adverse under NEPA, the effects of habitat loss and conversion from Alternative 1B on Suisun song sparrow would not be adverse under NEPA. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Under Alternative 1B, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,152 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to mitigate the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the study area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the impact of construction activities on nesting saltmarsh common yellowthroat to a less-than-significant level.

Because the number of acres required to meet the typical mitigation ratio described above would be only 3,590 acres of restored/created tidal natural communities, the 6,000 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for Suisun song sparrow, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1B as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a covered species under the BDCP. Although preconstruction surveys for Suisun song sparrow may detect nesting saltmarsh common yellowthroat, in order to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting saltmarsh common yellowthroat to a less-than-significant level.

Considering these restoration provisions, which would replace low-value secondary habitat with high-value tidal brackish emergent habitat, including both foraging and primary habitat, and provide upland refugia for Suisun song sparrow and saltmarsh common yellowthroat, the acreages of restoration would be sufficient to mitigate habitats lost to construction and restoration activities. Loss of habitat or direct mortality through implementation of Alternative 1B, with the implementation of AMM1–AMM7, AMM22, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-81: Indirect Effects of Plan Implementation on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Indirect Construction-Related Effects: If Suisun song sparrow or saltmarsh common yellowthroat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Suisun song sparrow and saltmarsh common yellowthroat habitat adjacent to restoration work areas could be affected by such disturbances, which could temporarily result in diminished use of habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect either species. If construction occurred during the nesting season, these indirect effects could result in the loss or abandonment of nests and mortality of any eggs and/or nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of Suisun song sparrow and saltmarsh common yellowthroat by requiring preconstruction surveys and, if nests are present, the establishment of a no-disturbance buffer within 250 feet of a nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Salinity: Water conveyance facilities operations would have an effect on salinity gradients in Suisun Marsh; however, these effects cannot be reasonably disaggregated from effects resulting from tidal habitat restoration. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water conveyance facilities operations and operations of salinity control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more saline environments, which should have a beneficial effect on Suisun song sparrow and saltmarsh common yellowthroat because their historical natural Suisun Marsh habitat is brackish tidal marsh. However, the degree to which salinity changes in all tidal channels and sloughs in and around Suisun Marsh would be highly variable.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Although tidal habitat restoration might increase methylation of mercury export to other habitats, restoration is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. Robinson et al. (2011) found toxic levels of methylmercury levels in song sparrow populations from southern San Francisco Bay, although populations near Suisun Marsh (i.e., San Pablo and Simas Creeks) were much lower. The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. The Suisun Marsh Plan anticipates that restored tidal wetlands would generate less methylmercury than the existing managed wetlands to be restored (Bureau of Reclamation et al. 2010).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz

2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Suisun song sparrow and saltmarsh common yellowthroat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Suisun song sparrow and saltmarsh common yellowthroat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Suisun song sparrow and saltmarsh common yellowthroat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances would not have an adverse effect on Suisun song sparrow with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects of noise and visual disturbance on saltmarsh common yellowthroat. AMM1–AMM7, including *AMM2*

Construction Best Management Practices and Monitoring, would minimize the likelihood of spills, and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration would be expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration is unlikely to have a substantial impact on Suisun song sparrow and saltmarsh common yellowthroat through increased exposure to methylmercury, as these species currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*. Changes in salinity gradients would be expected to have a beneficial impact on Suisun song sparrow and saltmarsh common yellowthroat through the establishment of tidal marsh similar to historic conditions.

The implementation of tidal natural communities restoration (CM4) is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. With these additional avoidance and minimization measures, Mitigation Measure BIO-75, and *CM12 Methylmercury Management*, indirect effects of Plan implementation would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the study area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the study area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the study area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 1B would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-1B-35. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the Swainson's hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM11).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Conserve at least 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat (Objective SH1.1, associated with CM3).
- Protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Of the at least 42,275 acres of cultivated lands protected as Swainson's hawk foraging habitat under Objective SH1.2, up to 1,500 acres can occur in CZs 5 and 6, and must have land surface elevations greater than −1 foot NAVD88 (Objective SH1.3, associated with CM3).
- Protect at least 10,750 acres of grassland, vernal pool, and alkali seasonal wetland as Swainson's hawk foraging habitat (Objective SH1.4, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk,* impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-35. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	34	34	23	23	NA	NA
	Foraging	5,494	5,494	9,640	9,640	NA	NA
Total Impacts CM1		**5,528**	**5,528**	**9,663**	**9,663**	**NA**	**NA**
CM2–CM18	Nesting	252	412	54	85	41–70	189
	Foraging	8,903	48,511	504	1,540	3,025–6,635	8,008
Total Impacts CM2–CM18		**9,155**	**48,923**	**558**	**1,625**	**3,066-6,705**	**8,197**
Total Nesting		**286**	**446**	**77**	**108**	**41–70**	**189**
Total Foraging		**14,397**	**54,005**	**10,144**	**11,180**	**3,025–6,635**	**8,008**
TOTAL IMPACTS		**14,683**	**54,451**	**10,221**	**11,288**	**3,066–6,705**	**8,197**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 65,739 acres of modeled habitat (554 acres of nesting habitat and 65,185 acres of foraging habitat) for Swainson's hawk (Table 12-1B-35). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B water conveyance facilities would result in the combined permanent and temporary loss of up to 54 acres of Swainson's hawk nesting habitat (34 acres of permanent loss and 23 acres of temporary loss). The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. Other small patches or narrow bands of riparian vegetation dominated by valley oak, willow, cottonwood or mixed brambles would be permanently removed by canal construction adjacent to Intake 1, between Intakes 2 and 4, and just south of Lambert Road. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal.

In addition, 15,134 acres of foraging habitat would be removed (5,494 acres of permanent loss and 9,640 acres of temporary loss; Table 12-1B-36). Permanent foraging habitat impacts from CM1 include 1,678 acres of impact on very high-value foraging habitat (alfalfa; Table 12-1B-36). The permanent and temporary losses would occur at various locations along the new canal route from the construction of the canal and the associated borrow and spoil sites and at the intake sites along the Sacramento River. Permanent and temporary losses of foraging habitat would also occur at the new forebay site just south of Clifton Court Forebay and associated borrow and spoil sites. There are 12 occurrences of Swainson's hawk that intersect with the permanent construction footprint for CM1. In addition, 13 occurrences intersect with temporary impacts from the CM1 footprint. The implementation of *AMM18 Swainson's Hawk* would require preconstruction surveys and the establishment of no-disturbance buffers and would minimize potential effects on nesting Swainson's hawks present within or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

Table 12-1B-36. Acres of Impacted Swainson's Hawk Foraging Habitat by Value Classes

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	CM1 Permanent (temporary)	CM2–CM18 Permanent (temporary)
Very high	Alfalfa hay	1,678 (3,365)	13,898 (432)
Moderate	Irrigated pasture, other hay crops, tomatoes, grain crops (wheat, barley, oats), fallow fields	1,257 (1,711)	15,136 (477)
Low	Other irrigated field and truck crops, dry pasture, grasslands, alkali seasonal wetlands, vernal pool complex, sudan	1,115 (1,414)	10,535 (349)
Very low	Safflower, sunflower, corn, grain sorghum, managed wetlands	1,444 (3,152)	8,943 (281)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 133 acres of nesting habitat (79 acres of permanent loss, 54 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,500 acres of foraging habitat would be removed (996 acres of permanent loss, 554 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove Swainson's hawk habitat. The loss is expected to occur during the first 10 years of Plan implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 295 acres of Swainson's hawk nesting habitat and 37,359 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. Impacts on foraging habitat from CM4 would consist of 10,757 acres of very high-value (alfalfa), 11,706 acres of moderate-value, and 7,973 acres of low-value habitat (See Table 12-1B-36 for land cover types classified by habitat value). Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. However, the conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM4, suggesting that numerous nest sites could be directly affected by inundation from tidal restoration activities.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 69 acres of Swainson's hawk nesting habitat (38 acres of permanent loss, 31 acres of temporary loss) and 2,856 acres of foraging habitat (1,820 acres of permanent loss, 1,036 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 953 acres of Swainson's hawk foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of Swainson's hawk agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of Swainson's hawk foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 1,440 acres of Swainson's hawk foraging habitat in CZ 2 and

CZ 4. Small patches of riparian vegetation that support Swainson's hawk nesting habitat may develop along the margins of restored nontidal marsh if appropriate site conditions are present.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of Swainson's hawk grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of Swainson's hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

Permanent and temporary nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk,* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 363 acres (286 permanent, 77 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 57 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 24,451 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 15,134 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 57 acres of nesting habitat should be restored/created and 57 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 15,134 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller)

within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (five gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 1B would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 554 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 65,185 acres of foraging habitat (14% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community

(Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1-4, 7- 9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of Swainson's hawk habitat and potential for direct mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on Swainson's hawk under Alternative 1B would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. The Plan would remove 363 acres (286 permanent, 77 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 57 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration Riparian*, and *CM7 Natural Community Restoration*—306 acres). In addition, 24,451 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 15,134 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 57 acres of nesting habitat should be restored/created and 57 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 15,134 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small

but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences and the removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that are incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 1B would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 554 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 65,185 acres of foraging habitat (14% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration,* and *CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of Swainson's hawk foraging habitat would be protected within of the 45,405 acres of cultivated lands protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1-4, 7- 9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Swainson's hawk.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. This species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the Plan Area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

***NEPA Effects*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

***CEQA Conclusion*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of Plan Implementation on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. These construction activities would include water conveyance construction, tidal restoration activities, floodplain restoration, and Fremont Weir/Yolo Bypass Enhancements. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with BDCP actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

NEPA Effects**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

CEQA Conclusion**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 3,066–6,706 acres of modeled Swainson's hawk habitat (consisting of approximately 41–70 acres of nesting habitat and 3,025–6,635 acres of foraging habitat; Table 12-1B-36). However, project-associated inundation of areas that would not otherwise have been inundated would be expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the project-related inundation area already inundates in the bypass. Therefore, habitat conditions in the bypass would not be expected to change substantially as a result of Yolo Bypass operations. However, increased duration of inundation during years of Fremont Weir operation, may delay the period for which foraging habitat is available to Swainson's hawks by up to several weeks.

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 8,197 acres of modeled Swainson's hawk habitat (Table 12-1B-35), consisting of 189 acres of nesting and 8,008 acres of foraging habitat. Floodplain restoration would be expected to restore a more natural flood regime and sustain riparian vegetation types that support regeneration of Swainson's hawk nesting habitat. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years)

to areas that flood infrequently (e.g., every 10 years or more). Foraging habitat that is inundated after Swainson's hawks arrive in the Central Valley in mid-March could result in a periodic loss of available foraging habitat due to the reduction in available prey. Inundated habitats would be expected to recover following draw-down and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic and short term effect that is unlikely to affect Swainson's hawk distribution and abundance, or foraging use of the study area.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not have a significant impact on Swainson's hawk.

Tricolored Blackbird

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on tricolored blackbird. The habitat model used to assess effects for tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass and along the southwestern perimeter of the Plan Area, breeding colonies are uncommon in the Plan Area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the Plan Area. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the Plan Area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of tricolored blackbird modeled habitat as indicated in Table 12-1B-37. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the tricolored blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and manage at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11. (Objective TRBL1.1).
- Protect at least 26,300 acres of moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, 50% of which is of high or very high value (Objective TRBL1.2).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. At least 1,000 acres of which will be within 5 miles of the at least 50 acres of nesting habitat protected under Objective TRBL1.1 (Objective TRBL1.3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-37. Changes to Tricolored Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]		Habitat Type	Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	Nesting	7	7	3	3	NA	NA
		Foraging - cultivated	1,005	1,005	1,197	1,197	NA	NA
		Foraging- noncultivated	198	198	183	183	NA	NA
	Nonbreeding	Roosting	16	16	35	35	NA	NA
		Foraging - cultivated	2,993	2,993	6,032	6,032	NA	NA
		Foraging - noncultivated	202	202	175	175	NA	NA
Total Impacts CM1			**4,421**	**4,421**	**7,625**	**7,625**		
CM2–CM18	Breeding	Nesting	13	72	75	77	11-26	30
		Foraging- cultivated	1,657	9,525	84	359	1,837–2,598	2,124
		Foraging noncultivated	704	1,991	155	184	600–1,689	355
	Nonbreeding	Roosting	570	1,642	0	1	0–4	29
		Foraging - cultivated	3,747	23,955	54	420	222–1,057	2,506
		Foraging - noncultivated	459	1,341	0	3	42–191	158
Total Impacts CM2–CM18			**7,150**	**38,526**	**368**	**1,044**	**2,711**	**5,766**
Total Breeding			**3,584**	**12,798**	**1,697**	**2,003**	**2,447–4,312**	**2,509**
Total Nonbreeding			**7,987**	**30,149**	**6,296**	**6,666**	**263–1,252**	**2,694**
TOTAL IMPACTS			**11,571**	**42,947**	**7,993**	**8,669**	**2,711**	**5,766**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 51,616 acres of modeled habitat (14,801 acres of breeding habitat and up to 36,815 acres of nonbreeding habitat) for tricolored blackbird (Table 12-1B-37). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of 1,210 acres of tricolored blackbird breeding habitat (7 acres nesting habitat, 1,005 acres of cultivated lands, and 198 acres of noncultivated lands suitable for foraging) and 3,211 acres of nonbreeding habitat (16 acres roosting habitat, 2,993 acres of cultivated lands, and 202 acres of noncultivated lands suitable for foraging; Table 12-1B-37). In addition, 1,383 acres of breeding habitat (3 acres of roosting, 1,197 acres of cultivated lands, and 183 acres of noncultivated lands suitable for foraging) and 6,242 acres of nonbreeding habitat (35 acres of roosting, 6,032 acres of cultivated lands, and 175 acres of noncultivated lands suitable for foraging) would be temporarily removed. Most of the habitat that would be lost is located in the central Delta, from CZs 3-6 and CZ 8. Nesting and roosting habitat would be removed as a result of the construction of the canal, and temporary work areas associated with construction. Foraging habitat losses would occur along the canal alignment primarily from the construction of the canal and the associated borrow and spoil sites. Foraging habitat would also be lost as a result of the construction of the new forebay in CZ 8. There are no occurrences of tricolored blackbird that overlap with the construction footprint for CM1. However, records exist throughout the study area. The implementation of *AMM21 Tricolored Blackbird* would minimize potential effects on tricolored blackbirds if they were to nest adjacent to construction areas (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would permanent loss of 595 acres of tricolored blackbird breeding habitat (13 acres nesting habitat, 477 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 8 acres of nonbreeding habitat (consisting entirely of roosting habitat). In addition, CM2 construction would result in the temporary removal of 314 acres of breeding habitat (75 acres nesting habitat, 84 acres of cultivated lands, and 155 acres of noncultivated lands suitable for foraging) and 54 acres of nonbreeding habitat (consisting entirely of cultivated lands). The loss is expected to occur during the first 10 years of Plan implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 3,937 acres of tricolored blackbird breeding habitat (21 acres of nesting, 2,814 acres of cultivated lands, and 1,102 acres of noncultivated lands suitable for foraging) and 10,794 acres of nonbreeding habitat (1,633 acres of roosting, 18,489 acres of cultivated lands, and 672 acres of noncultivated lands suitable for foraging). An estimated 13,692 acres of the 28,424 acres to be permanently lost would be expected to convert to tidal emergent wetland communities that could provide nonbreeding season roosting habitat for tricolored blackbirds, depending on future vegetation density and composition. Conversion would result in the loss of an estimated 4,316 acres of tricolored blackbird breeding habitat (34 acres of nesting habitat; plus 3,635 acres of cultivated lands and 647 acres of noncultivated habitats suitable for foraging) and 9,375 acres of nonbreeding habitat (8,716 acres of cultivated lands and 659 acres of noncultivated habitats suitable for foraging). These habitat losses and conversions would occur in CZs 1, 2, 4, 5, 6, 7, 8, and 11. Although considered to be a permanent loss, due to the uncertainty of the quantity of restored suitable habitat, any areas that develop into riparian scrub-shrub could provide suitable nesting and roosting habitat for tricolored blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction and riparian restoration associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent removal of up to 554 acres of tricolored blackbird breeding habitat (4 acres of nesting habitat, 503 acres of cultivated lands, and 47 acres of noncultivated habitats suitable for foraging) and 656 acres of nonbreeding habitat (1 acre of roosting habitat, 652 acres of cultivated lands, and 3 acres of noncultivated habitats suitable for foraging) in CZ 7. Patches of riparian scrub associated with the restoration of approximately 1,000 acres of valley/foothill riparian habitat managed as early- to mid-successional habitats (as a component of CM5) could provide suitable nesting, roosting or foraging habitat for tricolored blackbird once these restored habitats have developed habitat functions for the species.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland would result in the permanent removal of 1,521 acres of tricolored breeding habitat and 210 acres of nonbreeding habitat. Grassland restoration would be implemented on cultivated lands and would therefore result in the conversion of tricolored blackbird cultivated foraging habitat to high-value grassland foraging habitat in CZs 2, 4, and 5.

- *CM10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 568 acres of tricolored blackbird breeding habitat and 945 acres of nonbreeding habitat (all cultivated lands suitable for foraging). About two-thirds of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide low-value roosting habitat for tricolored blackbird depending on vegetation density and composition.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 43.5 acres of breeding habitat and 6.5 acres of nonbreeding habitat (all grassland suitable for foraging) would be lost as a result of construction of trails and facilities. Impacts from recreation facilities that would occur within the first 10 years of Plan implementation would include a loss of 13 acres of breeding habitat.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of tricolored blackbird grassland foraging habitat in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 250 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,281 acres of breeding habitat (98 acres of nesting, 3,943 acres of cultivated lands, and 1,240 acres of noncultivated lands suitable for foraging) and 14,283 acres of nonbreeding habitat (621 acres of roosting, 12,826 acres of cultivated lands, and 836 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,593 acres of breeding, 9,453 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain*

Restoration, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 10 acres of restoration and 10 acres of protection of nesting habitat, 51 acres of restoration and 51 acres of protection of roosting habitat, 1,436 acres of protection of noncultivated lands that provide foraging habitat, 2,202 acres of protection of cultivated lands suitable for foraging during the breeding season, and 9,025 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 98 acres of restoration and 98 acres of protection for nesting habitat, 621 acres of restoration and 621 acres of protection for roosting habitat, 4,152 acres of protection of noncultivated foraging habitat, 3,943 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 12,826 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1B-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage, and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in an adverse effect on tricolored blackbird.

Table 12-1B-38. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands, unsprayed alfalfa, unsprayed sunflower, unsprayed mixed alfalfa	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies,	Corn, sunflower, alfalfa and mixed alfalfa, mixed pasture, native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grasses, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots, organic rice	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Mixed grain and hay crops, farmsteads, non-irrigated mixed grain and hay, rice	Wheat, oats, mixed grain and hay, farmsteads, unirrigated mixed grain and hay, and non-irrigated misc. grain and hay

[a] Generally March through August; occasional breeding in fall (September through November).

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP Chapter 5, *Effects Analysis*). Alternative 1B as a whole would result in the permanent loss of and temporary effects on 14,801 acres of breeding habitat and 36,815 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (9% of the total breeding habitat in the study area and 14% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). In addition,

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1B-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of

these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The losses of tricolored blackbird habitat and potential for direct mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM5, CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, and *AMM21 Tricolored Blackbird*, which would be in place throughout the construction period, the effects of habitat loss or potential for mortality on tricolored blackbird would not be adverse under Alternative 1B.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 5,281 acres of breeding habitat (98 acres of nesting, 3,943 acres of cultivated lands, and 1,240 acres of noncultivated lands suitable for foraging) and 14,283 acres of nonbreeding habitat (621 acres of roosting, 12,826 acres of cultivated lands, and 836 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,593 acres of breeding, 9,453 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 10 acres of restoration and 10 acres of protection of nesting habitat, 51 acres of restoration and 51 acres of protection of roosting habitat, 1,436 acres of protection of noncultivated lands that provide foraging habitat, 2,202 acres of protection of cultivated lands suitable for foraging during the breeding season, and 9,025 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 98 acres of restoration and 98 acres of protection for nesting habitat, 621 acres of restoration and 621 acres of protection for roosting habitat, 4,152 acres of protection of noncultivated foraging habitat, 3,943 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 12,826 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1B-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage, and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in a significant impact on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP, Chapter 5, *Effects Analysis*). Alternative 1B as a whole would result in the permanent loss of and temporary effects on 14,801 acres of breeding habitat and 36,815 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (9% of the total breeding habitat in the study area and 14% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). In addition,

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1B-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres of breeding habitat and 31,090 acres of nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres of breeding habitat and 28,811 acres of nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 1B as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird. There are three other factors relevant to effects on tricolored blackbird.

- Very little loss of nesting habitat would occur (up to 84 acres of permanent loss and 90 acres of temporary loss).
- Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the Plan Area, so the loss is not expected to adversely affect the population in the Plan Area.
- Most temporary impacts would be on cultivated lands and grasslands that could be restored relatively quickly to suitable foraging habitat after completion of construction activities.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 1B as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area). Although migratory movements and daily flights between roosting and foraging habitat make may increase the risk of strike hazard, daily flights associated with winter foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the Plan Area currently poses these risks, and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal.

NEPA Effects: New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on tricolored blackbird.

CEQA Conclusion: New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 1B would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of Plan Implementation on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1.900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored*

Blackbird would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 250 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting or roosting colony. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury.

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. Furthermore, the Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands, potentially reducing the overall risk. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community and floodplain restoration could indirectly affect tricolored blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP).

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*. Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effects.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1–AMM7, AMM21, AMM27, and CM12 in place, the indirect effects of Alternative 1B implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 2,447–4,312 acres of breeding habitat and 263–1,252 acres of nonbreeding habitat (Table 12-1B-37). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 2,509 acres of breeding habitat (30 acres of nesting, 2,124 acres of cultivated lands, 355 acres of noncultivated lands suitable for foraging) and 2,694 acres of nonbreeding habitat(29 acres of roosting, 2,506 acres of cultivated lands, 158 acres of noncultivated lands suitable for foraging, Table 12-1B-37) resulting in the temporary loss of these habitats. Tricolored blackbirds are highly nomadic during the winter and would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat. There would be no expected adverse effect on tricolored blackbird.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would not result in an adverse effect on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would have a less-than-significant impact on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

Western Burrowing Owl

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-1B-39. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the western burrowing owl (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 1,000 acres of cultivated lands in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 mile of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1, associated with CM3).
- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands and vernal pool complex in CZs 1, 8, and/or 11 to achieve no net loss of wetted acres (Objectives ASWNC1.2 and VPNC1.2, associated with CM9)

- Increase burrow availability and prey abundance and accessibility (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, VPNC2.5, GNC2.3, and GNC2.4, associated with CM11)
- Protect at least 48,600 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species and maintain and protect the small patches of important wildlife habitats associated with cultivated lands (Objectives CLNC1.1 and CLNC1.3, associated with CM3)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7 and *AMM23 Western Burrowing Ow*l, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-39. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	697	697	714	714	NA	NA
	Low-value	2,788	2,788	6,315	6,315	NA	NA
Total Impacts CM1		**3,485**	**3,485**	**7,029**	**7,029**	**NA**	**NA**
CM2–CM18	High-value	4,487	11,570	245	328	1,390–3,303	779
	Low-value	3,527	28,506	144	971	1,522–2,927	6,162
Total Impacts CM2–CM18		**8,014**	**40,076**	**389**	**1,299**	**2,912–6,230**	**6,941**
Total High-value		**5,184**	**12,267**	**959**	**1,042**	**1,390–3,303**	**779**
Total Low-value		**6,315**	**31,294**	**6,459**	**7,286**	**1,522–2,927**	**6,162**
TOTAL IMPACTS		**11,499**	**43,561**	**7,418**	**8,328**	**2,912–6,230**	**6,941**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 51,881 acres of modeled habitat for western burrowing owl (of which 13,309 acres is of high value and 38,580 acres is of low value, Table 12-1B-39). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), grassland restoration (CM8), marsh restoration (CM10), and conservation hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 1,411 acres of acres of modeled high-value western burrowing owl habitat (697 acres of permanent loss, 714 acres of temporary loss) from CZs 3–6 and CZ 8. In addition, 9,103 acres of low-value burrowing owl habitat would be removed (2,788 acres of permanent loss, 6,315 acres of temporary loss) from CZs 3–6 and CZ 8. Losses of high and low-value habitat would occur primarily from the construction of intakes 1-5, the construction of the canal and associated borrow and spoil areas, and the construction of the new forebay in CZ 8. The footprint for CM1 does not overlap with any occurrences of western burrowing owl. However, there is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from facility construction and the establishment of the forebay borrow and spoils area could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat. The implementation of *AMM23 Western Burrowing Owl* would minimize potential effects on western burrowing owl if they were present in the construction area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1B implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,127 acres of high-value western burrowing owl habitat (882 acres of permanent loss, 245 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 242 acres of low-value habitat would be removed (98 acres of permanent loss, 144 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 29,668 acres of modeled western burrowing owl habitat in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. The majority of removed or converted acres (19,739 acres) is composed of low-value habitat. However, 9,929 acres of high-value habitat would also be lost from tidal restoration actions. Tidal restoration would directly impact and fragment remaining high-value grassland habitat just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Tidal natural community restoration efforts would impact one extant record of burrowing owl just northeast of Oakley along Dutch Slough and one possibly extirpated record in Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,504 acres of modeled western burrowing owl in CZs 2, 4, and 7. This total is comprised of 2,279 acres of low-value habitat. Also, 225 acres of high-value grassland habitat would be removed (142 permanent, 83 temporary) consisting of small patches of habitat along the San Joaquin, Old, and Middle Rivers in CZ 7.
- *CM6 Channel Margin Enhancement*: Sites for channel margin enhancement would be located along levees where western burrowing owl could be present. The species is known to use often the grassland edges along canals and levees in agricultural areas. The implementation of *AMM23 Western Burrowing Owl* would reduce the potential for channel margin enhancement activities to disturb owls or affect active nests.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 11 acres of high-value burrowing owl habitat as part of tidal restoration. In addition, 960 acres of low-value habitat would be removed as a part of tidal restoration and 3,991 acres would be removed as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would primarily be implemented on agricultural lands and would result in the permanent loss of 1,676 acres (362 acres of high-value and 1,314 acres of low-value) of western burrowing owl habitat. The conversion of 1,676 acres of low-value habitat to high-value grassland, would temporarily remove available habitat but would ultimately have a beneficial effect on the western burrowing owl.
- *CM10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 159 acres of high-value and 952 acres of low-value western burrowing owl habitat.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

Habitat management- and enhancement-related activities and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* into the BDCP which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value western burrowing owl habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 6,143 acres (5,184 acres permanent, 959 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,411 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 12,774 acres of low-value habitat would be removed or converted in the near-term (CM1, 9,103 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 2,822 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 9,103 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the plan area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on western burrowing owl high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of high-value burrowing owl habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat,* would be available to address the adverse effect of high-value habitat loss in the near-term.

The compensation for the loss of low-value burrowing owl habitat from the other near-term impacts would be 6,000 acres less than the typical ratio of 1:1 protection. However, 6,459 acres of all near-term impacts on low-value habitat would be temporary and would be restored within 1 year of the completion of construction. In addition, a proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat and the near-term conservation acres would be sufficient to compensate for the permanent impacts on low-value habitat for the species. The management and enhancement of cultivated lands and protected grasslands including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any potential effect from the near-term loss of low-value foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,309 acres of high-value habitat and 38,580 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western burrowing owl habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, *AMM23 Western Burrowing Owl*, and with implementation of Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl would not be adverse under Alternative 1B.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 6,143 acres (5,184 acres permanent, 959 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,411 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 12,774 acres of low-value habitat would be removed or converted in the near-term (CM1, 9,103 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 2,822 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 9,103 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the plan area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on western burrowing owl high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of high-value burrowing owl habitat at a ratio of 2:1. Implementation of Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat,* would reduce the impact of high-value habitat loss in the near-term.

The compensation for the loss of low-value burrowing owl habitat from the other near-term impacts would be 6,000 acres less than the typical ratio of 1:1 protection. However, 6,459 acres of all near-term impacts on low-value habitat would be temporary and would be restored within 1 year of the completion of construction. In addition, a proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat and the near-term conservation acres would be sufficient to compensate for the permanent impacts on low-value habitat for the species. The management and enhancement of cultivated lands and protected grasslands including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any potential effect from the near-term loss of low-value foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

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Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,309 acres of high-value habitat and 38,580 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM23 Western Burrowing Owl,* and Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western burrowing owl.

Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

Because the BDCP lacks acreage commitment for specific crop types that would be managed within the 15,400 acres of cultivated lands protected in the near-term time period, DWR will compensate for the loss of high-value burrowing owl habitat with high-value natural communities or cultivated crop types a ratio of 2:1 in the near-term time period.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given the species' physical and behavioral characteristics (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). New transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of Plan Implementation on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of modeled habitat adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with the implementation of *AMM23 Western Burrowing Owl* into the BDCP, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

NEPA Effects: Indirect effects on western burrowing owl as a result of Alternative 1B implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western*

Burrowing Owl, the indirect effects from Alternative 1B implementation would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects on western burrowing owl as a result of Alternative 1B implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 1B implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,195–3,004 acres of high-value habitat and 1,522–2,927 acres of low-value habitat (Table 12-1B-39).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 6,941 acres of modeled habitat (6,162 acres of which would be low-value foraging habitat; Table 12-1B-39).

Burrowing owls cannot use inundated areas for foraging or nesting, and increased inundation frequency and duration of cultivated lands and grassland habitats may affect prey populations that have insufficient time to recover following inundation events. Depending on timing, seasonal inundation of western burrowing owl habitat could result in displacement from nesting burrows or drowning of individuals. The potential for this effect is considered low because suitable burrow sites would most likely be located along setback levees, which are expected to be subject to inundation less frequently than floodplain surfaces that would be less likely to support suitable nesting burrows. The periodically inundated habitat would not be expected to have an adverse effect on the population.

NEPA Effects: The periodically inundated habitat would not be expected to have an adverse effect on the population. The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation; therefore, the potential impact would not be adverse.

CEQA Conclusion: The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation. Therefore, periodic inundation would be expected to have a less-than-significant impact on the population.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on western yellow-billed cuckoo. The habitat model for western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres. Modeled habitat also includes migratory habitat, which contains the same plant alliances as breeding habitat but without the minimum 50-acre patch size requirement.

The western yellow-billed cuckoo is uncommon in the Plan Area at present, and the likelihood that it will be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the plan area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of Western yellow-billed cuckoo modeled habitat as indicated in Table 12-1B-40. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the western yellow-billed cuckoo (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on Western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-40. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	3	3	0	0	NA	NA
	Migratory	15	15	26	26	NA	NA
Total Impacts CM1		**18**	**18**	**26**	**26**	**NA**	**NA**
CM2–CM18	Breeding	29	142	5	10	11–20	17
	Migratory	278	383	83	94	37–64	125
Total Impacts CM2–CM18		**307**	**525**	**88**	**104**	**48–84**	**142**
Total Breeding		**32**	**145**	**5**	**10**	**11–20**	**17**
Total Migratory		**293**	**398**	**109**	**120**	**37–64**	**125**
TOTAL IMPACTS		**325**	**543**	**114**	**130**	**48–84**	**142**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 673 acres of modeled habitat for western yellow-billed cuckoo (155 acres of breeding habitat, 518 acres of migratory habitat; Table 12-1B-40). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B water conveyance facilities would result in the permanent loss of up to 3 acres of modeled western yellow-billed cuckoo breeding habitat and the combined permanent and temporary loss of 41 acres of modeled migratory habitat (15 acres of permanent loss, 41 acres of temporary loss; Table 12-1B-40). The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Habitat loss would primarily occur as a result of the construction of Intakes 1-5, the construction of the canal, and temporary work areas. There are no stand occurrences of yellow-billed cuckoo nests in the study area. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the loss of approximately 31 acres of breeding habitat (26 acres of permanent loss and 5 acres of temporary loss) and 140 acres of migratory habitat (57 acres of permanent loss and 83 acres of temporary loss) for yellow-billed cuckoo in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1B implementation. There are no extant occurrences of yellow-billed cuckoo nesting in the study area.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 110 acres of modeled yellow-billed cuckoo breeding habitat and 310 acres of modeled migratory habitat in CZ 1, 2, 6, and 11. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove. These detections do not overlap with the hypothetical restoration areas for CM4.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 11 acres of modeled yellow-billed cuckoo breeding habitat (6 acres of permanent loss and 5 acres of temporary loss) and 27 acres of migratory habitat (16 acres of permanent loss and 11 acres of temporary loss) in CZ 7. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support western yellow-billed cuckoo habitat once the riparian vegetation has developed habitat functions for the cuckoo.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat over the term of the BDCP. With conditions favorable for its future establishment in the Plan Area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. *CM11 Natural Communities Enhancement and Management* actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values over the term of the BDCP.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection in 2009 in DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the present of suitable habitat indicates that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 439 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 44 acres [3 acres of breeding habitat; 41 acres of migratory habitat]), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 44 acres of valley/foothill riparian habitat should be restored/created and 44 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 673 acres of modeled habitat (5% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7 (Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat associated with Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, the species is not an established breeder in the plan area and current presence is limited to migrants. In addition, the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on western yellow-billed cuckoo would not be adverse under Alternative 1B.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 439 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 44 acres [3 acres of breeding habitat; 41 acres of migratory habitat]), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 44 acres of valley/foothill riparian habitat should be restored/created and 44 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

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The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7 (Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Pla*n, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on Western yellow-billed cuckoo from Alternative 1B would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species; however, considering Alternative 1B's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a minimal effect on the species.

***NEPA Effects*:** Fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area, it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors, which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. Because there is low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

NEPA Effects: The risk of bird strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of Plan Implementation on Western Yellow-Billed Cuckoo

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: Western yellow-billed cuckoo modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Cuckoos are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on western yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the western yellow-billed cuckoo. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on western yellow-billed cuckoo.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on western yellow-billed cuckoo from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Plan implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Indirect effects on western yellow-billed cuckoo as a result of Alternative 1B implementation could have a significant impact on the species from modification of habitat.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects as a result of Alternative 1B implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 11-20 acres of modeled western yellow-billed cuckoo breeding habitat and 37–64 acres of modeled migratory habitat. No adverse effects of increased inundation frequency on western yellow-billed cuckoo or its habitat are expected because the cuckoo breeding period is outside the period the weir would be operated. In addition, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 142 acres of modeled western yellow-billed cuckoo habitat (17 acres of breeding habitat, 125 acres of migratory habitat). Inundation of restored floodplains is not expected to affect western yellow-billed cuckoo or its habitat adversely because the cuckoo breeding period is outside the period the floodplains would likely be inundated, and periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for western yellow-billed cuckoo. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for western yellow-billed cuckoo, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Periodic effects of inundation would not have an adverse on yellow-billed cuckoo if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

White-Tailed Kite

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen 1995).

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-1B-41. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed*

Kite, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1B would also include the following biological objectives over the term of the BDCP to benefit the white-tailed kite (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM11)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM39 White-tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-41. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	40	40	39	39	NA	NA
	Foraging	5,475	5,475	9,594	9,594	NA	NA
Total Impacts CM1		**5,515**	**5,515**	**9,633**	**9,633**		
CM2–CM18	Nesting	312	507	88	121	48–82	230
	Foraging	8,723	52,675	516	1,484	3,030–6,651	7,402
Total Impacts CM2–CM18		**9,035**	**53,182**	**604**	**1,605**	**3,078–6,733**	**7,632**
Total Nesting		**352**	**547**	**127**	**160**	**48–82**	**230**
Total Foraging		**14,198**	**58,150**	**10,110**	**11,078**	**3,030–6,651**	**7,402**
TOTAL IMPACTS		**14,550**	**58,697**	**10,237**	**11,238**	**3,078–6,733**	**7,632**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 69,935 acres of modeled habitat (707 acres of nesting habitat and 69,388 acres of foraging habitat) for white-tailed kite (Table 12-1B-41). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B water conveyance facilities would result in the combined permanent and temporary loss of up to 79 acres of white-tailed kite nesting habitat (40 acres of permanent loss and 39 acres of temporary loss). The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. Other small patches or narrow bands of riparian vegetation dominated by valley oak, willow, cottonwood or mixed brambles would be permanently removed by canal construction adjacent to Intake 1, between Intakes 2 and 4, and just south of Lambert Road. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal.

In addition, 15,069 acres of foraging habitat would be removed (5,475 acres of permanent loss, 9,594 acres of temporary loss; Table 12-1B-41). The foraging habitat losses would occur at various locations along the new canal route from the construction of the canal and the associated borrow and spoil sites and at the intake sites along the Sacramento River. Permanent and temporary losses of foraging habitat would also occur at the new forebay site just south of Clifton Court Forebay and associated borrow and spoil sites. There are no occurrences of white-tailed kite that overlap with the CM1 construction footprint. However, the implementation of *AMM39 White-Tailed Kite* would minimize effects on white-tailed kites if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,525 acres of foraging habitat would be removed (1,008 acres of permanent loss, 516 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove white-tailed kite habitat. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 383 acres of white-tailed kite nesting habitat and 41,625 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of white-tailed kite nesting habitat (42 acres of permanent loss, 33 acres of temporary loss) and 2,675 acres of foraging habitat (1,706 acres of permanent loss, 968 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 971 acres of white-tailed kite foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of white-tailed kite agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh (CM10) would result in the permanent conversion of 1,440 acres of cultivated lands to nontidal marsh in CZ 2 and CZ 4. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of white-tailed kite grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-white-tailed kite foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

Permanent and temporary white-tailed kite nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM39 White-Tailed Kite* in addition to conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged white-tailed kite if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM39 White-Tailed Kite* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 479 acres (352 acres of permanent loss, 127 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 79 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 24,308 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 15,069 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, 1:1 protection for foraging habitat. Using these ratios would indicate that 79 acres of nesting habitat should be restored/created and 79 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 15,069 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. With this program in place, Alternative 1B would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 707 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 69,388 acres of foraging habitat (14% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide

foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite habitat and potential for direct mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM39 White-Tailed Kite*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on white-tailed kite under Alternative 1B would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. The Plan would remove 479 acres (352 acres of permanent loss, 127 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 79 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 24,308 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 15,069 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, 1:1 protection for foraging habitat. Using these ratios would indicate that 79 acres of nesting habitat should be restored/created and 79 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 15,069 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection

and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. Of the replacement trees planted, a variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With this program in place, Alternative 1B would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* nd *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 707 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 69,388 acres of foraging habitat (14% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide

foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on white-tailed kite habitat from Alterative 1B would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. In particular, 95% of the loss of foraging habitat effects involve the conversion of one habitat type to another form of suitable foraging habitat. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on white-tailed kite.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of bird strike mortality from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Appendix 5.J, Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines. ***NEPA Effects***: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on white-tailed kite.

CEQA Conclusion: The construction and presence of new transmission lines would not represent a significant impact because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of Plan Implementation on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM39 White-Tailed Kite* would require preconstruction surveys, and if detected, 200-yard no-disturbance buffers would be established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on white-tailed kite.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect white-tailed kite use of the surrounding habitat. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1B would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1B implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1B would have a less-than-significant impact on white-tailed kite with the implementation of *AMM39 White-Tailed Kite*, and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1B implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations related to *CM2 Yolo Bypass Fisheries Enhancement* would increase the frequency and duration of inundation on approximately 48–82 acres of modeled white-tailed kite nesting habitat and 3,030–6,651 acres of modeled white-tailed kite foraging habitat (Table 12-1B-41). During inundation years, affected cultivated lands and grassland would not be available as foraging habitat until prey populations have re-inhabited inundated areas. This would result in temporary periodic reduction in availability of foraging habitat. If late-season Fremont Weir operations were to preclude the planting of some crop types, there could be a further loss of foraging habitat value if the crop type that would have been planted would provide greater foraging habitat value than the fallowed fields. No known white-tailed kite nest sites would be affected, and increased periodic flooding is not expected to cause any adverse effect on nest sites that may be within the inundation area because existing trees already withstand floods in the area, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and any nest sites would be located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to approximately 230 acres of modeled white-tailed kite nesting habitat and 7,402 acres of modeled white-tailed kite foraging habitat (Table 12-1B-41). Inundation of foraging habitat could result in a periodic reduction of available foraging habitat due to the reduction in available prey. Following draw-down, inundated habitats are expected to recover and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic impact that is unlikely to affect white-tailed kite distribution and abundance, or foraging use of the Plan Area.

Periodic inundation of floodplains (through CM2 and CM5) would be expected to restore a more natural flood regime in support of riparian vegetation types that support white-tailed kite nesting habitat. No adverse effects of inundation on white-tailed kite riparian habitat are expected because valley/foothill riparian vegetation is expected to benefit from seasonal inundation.

NEPA Effects: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would not result in an adverse effect.

CEQA Conclusion: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would be expected to have a less-than-significant impact on white-tailed kite.

Yellow-Breasted Chat

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking. For this reason, the effects analysis only provides the breakdown between primary and secondary habitat in the habitat loss totals and associated tables, and does not provide this breakdown in the text by activity or effect type.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-1B-42. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit the yellow-breasted chat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-42. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Nesting and Migratory Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Primary	9	9	21	21	NA	NA
	Secondary	15	15	8	8	NA	NA
	Suisun Marsh/ Upper Yolo Bypass	0	0	0	0	NA	NA
Total Impacts CM1		**24**	**24**	**29**	**29**		
CM2–CM18	Primary	96	214	58	73	19–38	92
	Secondary	209	357	0	6	6–18	56
	Suisun Marsh/ Upper Yolo Bypass	76	85	29	29	23–32	0
Total Impacts CM2–CM18		**381**	**656**	**87**	**108**	**48–88**	**148**
Total Primary		**105**	**223**	**79**	**94**		
Total Secondary		**224**	**372**	**8**	**14**		
Total Suisun Marsh/Upper Yolo Bypass		**76**	**85**	**29**	**29**		
TOTAL IMPACTS		**405**	**680**	**116**	**137**	**48–88**	**148**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 817 acres of modeled nesting and migratory habitat for yellow-breasted chat (680 acres of permanent loss, 137 acres of temporary loss) (Table 12-1B-42). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up 30 acres of primary habitat (9 acres of permanent loss, 21 acres of temporary loss). In addition, 22 acres of secondary habitat would be removed (10 acres of permanent loss, 12 acres of temporary loss) (Table 12-1B-42). The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. A small area of riparian habitat (mostly blackberries) would be permanently removed in the south Delta at the new forebay construction site. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal. Tunnel construction at Old River just south of Victoria Canal would also temporarily remove mixed willows and brambles. There are no occurrences of yellow-breasted chat that overlap with the CM1 construction footprint. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize effects on yellow-breasted chat if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction would permanently remove approximately 83 acres and temporarily remove 88 acres of yellow-breasted chat habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled yellow-breasted chat habitat in CZ 1, 2, 6, and 11. This total is composed of an estimated 182 acres of primary nesting and migratory habitat, 349 acres of secondary nesting and migratory habitat, and 14 acres of nesting and migratory habitat in the Suisun Marsh and upper Yolo Bypass areas.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 49 acres of modeled yellow-breasted chat habitat in CZ 7. This total is comprised of 28 acres of primary nesting and migratory habitat and 21 acres of secondary nesting and migratory habitat. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support yellow-breasted chat habitat.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat over the term of the BDCP.

Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the Plan Area.

Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.
- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 521 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 53 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 53 acres of valley/foothill riparian habitat should be restored/created and 53 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have an adverse population-level effect on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 817 acres of modeled habitat (6% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-breasted chat habitat and potential direct mortality of this special-status species would represent an adverse effect in the absence of other conservation actions. The restored riparian habitat would require 5 years to several decades for ecological succession to occur and a similar period of time for restored riparian habitat to functionally replace habitat that has been affected. However, the habitat that would be lost consists of small, fragmented riparian stands that would not provide high-value habitat for the species. And because the nesting and migratory habitat that would be lost is small relative to the species range throughout California and North America, BDCP actions would not be expected to have an adverse population-level effect on the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on yellow-breasted chat under Alternative 1B would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impact of construction would be less than significant under CEQA. The Plan would remove 521 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 53 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 53 acres of valley/foothill riparian habitat should be restored/created and 53 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have a significant population-level impact on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 817 acres of modeled habitat (6% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge* Operations Plan, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on least Bell's vireo and yellow warbler habitat from Alternative 1B would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-breasted chat.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Because of the current infrequent occurrence and small numbers of yellow-breasted chat in the Plan Area, and because *CM5 Seasonally Inundated Floodplain Restoration* would restore and protect contiguous high-value riparian habitat in CZ 7, any such habitat fragmentation is expected to have no or minimal effect on the species.

***NEPA Effects*:** Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions will be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

***NEPA Effects*:** The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the study area during the summer when visibility is high. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

***CEQA Conclusion*:** The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the study area during the summer when visibility is high. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of Plan Implementation on Yellow-Breasted Chat

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP, which would ensure 250-foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, AMM22 would minimize this effect on the species.

Methylmercury Exposure: Yellow-breasted chat modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Chats are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the yellow-breasted chat. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-breasted chat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-breasted chat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions.

However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased exposure to selenium would be less than significant.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–88 acres of modeled yellow-breasted chat nesting and migratory habitat. No adverse effects of increased inundation frequency on yellow-breasted chat or its habitat are expected because the chat breeding period is outside the period the weir would be operated. Moreover, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 could result in periodic inundation of up to 148 acres of modeled yellow-breasted chat habitat. Inundation of restored floodplains is not expected to affect yellow-breasted chat or its habitat because the chat breeding period is outside the period the floodplains would likely be inundated. In addition, providing for periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for yellow-breasted chat. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects**:** Increases in the frequency and duration of Yolo Bypass flooding and CM5 floodplain restoration would be expected to create more natural flood regimes that would support riparian habitat, which would not result in an adverse effect on yellow breasted chat.

CEQA Conclusion**:** Periodic inundation would have a less-than-significant impact on yellow-breasted chat because inundation would occur outside of the breeding season and would not be expected to adversely modify habitat or result in direct mortality of the species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation would be beneficial for yellow-breasted chat.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled nesting habitat for these species is restricted to valley/foothill riparian forest.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-1B-43. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP which would also benefit Cooper's hawk and osprey (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the acres of restoration or protection included in the Plan, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-43. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	40	40	39	39	NA	NA
Total Impacts CM1		**40**	**40**	**39**	**39**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
Total Impacts CM2–CM18		**312**	**507**	**88**	**121**	**48–82**	**230**
TOTAL IMPACTS		**352**	**547**	**127**	**160**	**48–82**	**230**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 707 acres of modeled nesting habitat (547 acres of permanent loss, 160 acres of temporary loss) habitat for Cooper's hawk and osprey (Table 12-1B-43). Conservation measures that would result in these losses are *CM1 Water Facilities and Operation* (which would involve construction of conveyance facilities and transmission lines and establishment and use of borrow and spoil areas), *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B water conveyance facilities would result in the combined permanent and temporary loss of up to 79 acres of modeled Cooper's hawk and osprey habitat (Table 12-1B-43). Of the 79 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 40 acres would be a permanent loss and 39 acres would be a temporary loss of habitat. The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento

River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. Other small patches or narrow bands of riparian vegetation dominated by valley oak, willow, cottonwood or mixed brambles would be permanently removed by canal construction adjacent to Intake 1, between Intakes 2 and 4, and just south of Lambert Road. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* would be available to address potential effects on Cooper's hawk and osprey if either species were to nest in or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of Cooper's hawk and osprey nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential Cooper's hawk and osprey habitat. The loss is expected to occur during the first 10 years of Alternative 1B implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration could permanently remove up to 383 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of Cooper's hawk and osprey nesting habitat (42 acres of permanent loss, 33 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat could further reduce this limited resource and reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid having an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid having an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects**:** The loss of Cooper's hawk and osprey habitat and potential for direct mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss on Cooper's hawk and osprey under Alternative 1B would not be adverse. Cooper's hawk and osprey are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. The Plan would remove 449 acres (338 acres of permanent loss, 111 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of nesting habitat should be restored/created and 49 acres should be protected to mitigate the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios. The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid having a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting Cooper's hawk and osprey to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 677 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of Plan Implementation on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring,* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury*

Management contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cooper's hawk and osprey.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Cooper's hawk and osprey.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Cooper's hawk and osprey from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on cooper's hawk and osprey. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Cooper's hawk and osprey, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1B would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury through the ingestion of fish or small mammals in restored tidal areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would address the uncertainty of methylmercury levels in restored tidal marsh in the study area and better inform potential impacts on Cooper's hawk and osprey.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-82 acres of modeled Cooper's hawk and osprey breeding habitat However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 230 acres of breeding habitat for Cooper's hawk and osprey. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation resulting from CM2 and CM5 would not have an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation resulting from CM2 and CM5 would have a less-than-significant impact on Cooper's hawk and osprey.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-1B-44. Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP that would also benefit golden eagles or ferruginous hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-44. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Foraging	2,962	2,962	4,528	4,528	NA	NA
Total Impacts CM1		**2,962**	**2,962**	**4,528**	**4,528**	**NA**	**NA**
CM2–CM18	Foraging	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**8,412**	**29,160**	**4,904**	**5,421**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 34,581 acres of modeled foraging habitat for golden eagle and ferruginous hawk (29,160 acres of permanent loss and 5,421 acres of temporary loss; Table 12-1B-44). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 7,490 acres of modeled golden eagle and ferruginous hawk foraging habitat (2,962 acres of permanent loss, 4,528 acres of temporary loss) from CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8. The permanent and temporary losses would occur at various locations along the new canal route from the transmission line footprint, the construction of the canal and the associated borrow and spoil sites and at the intake sites along the Sacramento River. Permanent and temporary losses of foraging habitat would also occur at the new forebay site just south of Clifton Court Forebay and associated borrow and spoil sites. The CM1 construction footprint does not overlap with any occurrences of golden eagle or ferruginous hawk. However, some of the grassland habitat lost in CZ 8 is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which provides high-value foraging habitat for these species. There are no Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled golden eagle and ferruginous hawk foraging habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 20,880 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled golden eagle and ferruginous hawk foraging habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide foraging habitat for golden eagle and ferruginous hawk and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of golden eagle and ferruginous hawk foraging habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat for these species. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled golden eagle and ferruginous hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk. However, the conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on golden eagle and ferruginous hawk habitat. Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat* would be available to address the adverse effect of near-term habitat loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of modeled foraging habitat during the term of the Plan (13% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of golden eagle and ferruginous hawk habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the effects of habitat loss and potential direct mortality on golden eagle and ferruginous hawk under Alternative 1B would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk. However, the conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on golden eagle and ferruginous hawk habitat. The implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Habitat*, would reduce the near-term impact of habitat loss to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of modeled foraging habitat during the term of the Plan (13% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives

ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on golden eagle and ferruginous hawk foraging habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species; however, considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on golden eagle and ferruginous hawk.

Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide golden eagle and ferruginous hawk foraging habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters which would substantially reduce any potential for powerline collisions.

***NEPA Effects*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

***CEQA Conclusion*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on golden eagle or ferruginous hawk.

Impact BIO-115: Indirect Effects of Plan Implementation on Golden Eagle and Ferruginous Hawk

Indirect Construction- and Operation-Related Effects: Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1B implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1B implementation would not have an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1B implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1B implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat (Table 12-1B-44).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-1B-44).

Golden eagles and ferruginous hawks would not likely use inundated areas for foraging, and increased frequency and duration of inundation of grassland habitats may affect prey populations that have insufficient time to recover following inundation events. However, periodically inundated habitat would not be expected to have an adverse effect on local or migratory golden eagles or the wintering ferruginous hawk populations in the study area.

***NEPA Effects*:** Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would not be expected to have an adverse effect on the wintering golden eagle or ferruginous hawk populations in the study area.

***CEQA Conclusion*:** Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would be expected to have a less-than-significant impact on the golden eagle and ferruginous hawk populations in the study area.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-1B-45. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP which would also benefit cormorants, herons, and egrets (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).

- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measures BIO-75 and BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-45. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting (Rookeries)	51	51	39	39	NA	NA
Total Impacts CM1		**51**	**51**	**39**	**39**	**NA**	**NA**
CM2–CM18	Nesting (Rookeries)	387	684	88	123	51–92	266
Total Impacts CM2–CM18		**387**	**684**	**88**	**123**	**51–92**	**266**
TOTAL IMPACTS		**438**	**735**	**127**	**162**	**51–92**	**266**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 897 acres of modeled nesting habitat (735 acres of permanent loss and 162 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-1B-45). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B water conveyance facilities would result in the combined permanent and temporary loss of up to 90 acres of modeled nesting habitat for cormorants, herons, and egrets (Table 12-1B-45). Of the 90 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 51 acres would be a permanent loss and 39 acres would be a temporary loss of habitat. This loss would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. The habitat would be removed at multiple locations from the north Delta to the east Delta and in the vicinity of Clifton Court Forebay. Almost all of the losses would occur on the borders of waterways. In the north Delta, most of the permanent loss would occur where Intakes 1–5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees and scrub vegetation. In the east Delta, small permanent losses would occur from canal construction just south of Twin Cities Road and just north of Walnut Grove Road. A small area of riparian habitat (mostly blackberries) would be permanently removed in the south Delta at the new forebay construction site. The temporary riparian losses would occur at the intake sites along the Sacramento River and at temporary siphon work areas where the canal would cross Beaver Slough, Hog Slough, Sycamore Slough, White Slough, Disappointment Slough, Railroad Canal, and Middle River just south of Victoria Canal. Tunnel construction at Old River just south of Victoria Canal would also temporarily remove mixed willows and brambles. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

  The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. There is one great egret rookery that is currently intersected by a temporary siphon work area associated with CM1. The location of the rookery is on an inchannel island, north of Union Island and south of the town of Holt. Because the species is highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. Therefore, to avoid adverse effects on great blue herons (and cormorants, herons, and egrets, should future surveys detect additional rookeries), existing rookeries must be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address this adverse effect on cormorants, herons, and egrets. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 177 acres of nesting habitat (89 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential nesting habitat. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated552 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species. There is one CNDDB occurrence of a great blue heron rookery that overlaps with the hypothetical restoration footprint for tidal restoration. The occurrence is on Decker Island and tidal restoration could potentially impact the nest trees from inundation. This potential effect would need to be addressed within the project-specific analysis for tidal restoration projects.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 43 acres and temporarily remove approximately 35 acres of potential cormorants, heron, and egret nesting habitat. These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Because cormorants, herons and egrets are highly traditional in their use of nest sites, all disturbance to nesting birds must be avoided or minimized. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address these adverse effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 565 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 90 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 90 acres of breeding habitat should be restored/created and 90 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP avoid having an adverse effect on individuals, existing nests and rookeries would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address adverse effects on nesting cormorants, herons, and egrets.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 897 acres of potential breeding habitat (5% of the potential breeding habitat in the Plan Area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites, and for the BDCP to avoid having an adverse effect on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

NEPA Effects: The loss of cormorant, heron, and egret habitat and potential for direct mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss on cormorants, herons, and egrets under Alternative 1B would not be adverse. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid effects on these species, preconstruction surveys for noncovered species would be necessary to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under NEPA. The Plan would remove 565 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 90 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 90 acres of breeding habitat should be restored/created and 90 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure

BIO-117, *Avoid Impacts on Rookeries,* would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 897 acres of potential breeding habitat (5% of the potential breeding habitat in the Plan Area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites, and for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts sufficient to compensate for the loss of riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measures BIO-75 and BIO-117, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of these species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of Plan Implementation on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets.

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that cormorant, heron, and egret tissue concentrations would not measurably increase as a result of CM1 implementation.

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly effect on cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cormorants, herons or egrets.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management which* would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would represent an adverse effect in the absence of other conservation actions. This impact would be significant. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of*

Nesting Birds, Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7 would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium which could result in mortality of special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measures BIO-75 and BIO-117, indirect effects of plan implementation would not result in a substantial adverse effect on cormorants, herons, and egrets through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 51–92 acres of modeled breeding habitat for cormorants, herons and egrets. However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 266 acres of breeding habitat for cormorants, herons and egrets. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation from CM2 and CM5 would not result in an adverse effect on cormorants, herons and egrets.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation from CM2 and CM5 would have a less-than-significant impact on cormorants, herons and egrets.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-1B-46. Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP which would also benefit short-eared owl and northern harrier (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.2, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with Cm3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7, *AMM27 Selenium Management* and Mitigation Measures BIO-75 and BIO-121, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-46. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting and foraging	3,569	3,569	5,630	5,630	NA	NA
Total Impacts CM1		**3,569**	**3,569**	**5,630**	**5,630**	**NA**	**NA**
CM2–CM18	Nesting and foraging	12,281	46,700	471	1,224	2,926–8,060	5,978
Total Impacts CM2–CM18		**12,281**	**46,700**	**471**	**1,224**	**2,926–8,060**	**5,978**
TOTAL IMPACTS		**15,850**	**50,269**	**6,101**	**6,854**	**2,926–8,060**	**5,978**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 57,123 acres of modeled habitat for short-eared owl and northern harrier (50,269 acres of permanent loss and 6,854 acres of temporary loss, Table 12-1B-46). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), grassland restoration (CM8), vernal pool and wetland restoration (CM9), marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 2,785 acres of modeled short-eared owl and northern harrier habitat (2,012 acres of permanent loss, 773 acres of temporary loss). The majority of habitat removed would consist of grassland and alfalfa fields. Habitat losses would occur at various locations along the new canal route from the construction of the canal and the associated borrow and spoil sites and at the intake sites along the Sacramento River. Permanent and temporary losses of foraging habitat would also occur at the new forebay site just south of Clifton Court Forebay and associated borrow and spoil sites. There are no occurrences of nesting short-eared owl and northern harrier that overlap with the construction footprint of CM1. However, northern harrier nests were detected throughout the central Delta during DHCCP surveys and there is suitable habitat throughout the study area for both species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on short-eared owls and northern harriers if they were to nest in or adjacent to construction activities. The majority of habitat removed would be grassland and cultivated lands from proposed borrow and spoil sites adjacent to the canal alignment in CZs 4–8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 1,021 acres of modeled short-eared owl and northern harrier habitat in the Yolo Bypass in CZ 2. In addition, 471 acres of habitat would be temporarily removed. The impact would primarily consist of loss of acreages of pastures. The conversion is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 39,017 acres of modeled short-eared owl and northern harrier habitat. The majority of the losses would be managed wetlands and cultivated lands in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. Tidal restoration actions through CM4 would restore an estimated 55,000 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the extent and value of their nesting habitat. Grizzley Island supports the only known resident population of short-eared owls in the Suisun Marsh and Sacramento-San Joaquin River Delta (Roberson 2008). Grizzley Island does not overlap with the hypothetical footprint for CM4. However, this is an important breeding area for short-eared owl and if restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding short-eared owls could likely be adverse. Future NEPA and CEQA analysis would be conducted for restoration projects under BDCP and if restoration was proposed to occur outside of the hypothetical footprints used for this programmatic analysis, potential impacts on these species would be captured in the project-level analysis (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,086 acres of modeled short-eared owl and northern harrier habitat (1,332 permanent, 754 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 623 acres of short-eared owl and northern harrier habitat as part of tidal restoration and 2,479 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,066 acres of cultivated lands to grassland in CZs 1, 2, 4, 5, 7, 8, and 11. The resulting 2,000 acres of grassland would provide habitat for short-eared owl and northern harrier.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 *Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize these adverse effects.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of short-eared owl and northern harrier habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 21,951 acres of modeled habitat (15,850 permanent, 6,101 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 9,199 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 9,199 acres of habitat should be restored and 9,199 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions. The acres of restoration in the near-term satisfy the project-level effects of CM1, but are 1,661 acres short of satisfying the compensation required for other near-term impacts. Mitigation Measure BIO-121, *Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat*, would be available to address the adverse effect of near-term habitat loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 57,123 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (14% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect

600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to avoid having an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of short-eared owl and northern harrier habitat and potential for direct mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–

AMM7, which would be in place throughout the construction period, the effects of habitat loss from Alternative 1B would not be adverse under NEPA. Short-eared owl and northern harrier are not covered species under the BDCP, and preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the adverse effect of direct mortality on short-eared owl and northern harrier.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 21,951 acres of modeled habitat (15,850 permanent, 6,101 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 9,199 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 9,199 acres of habitat should be restored and 9,199 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions. The acres of restoration in the near-term satisfy the project-level effects of CM1, but are 1,661 acres short of satisfying the compensation required for other near-term impacts. The implementation of Mitigation Measure BIO-121, *Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat*, would reduce the impact of near-term habitat loss to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 57,123 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (14% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce the impact to a less-than-significant level.

Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measures BIO-75 and BIO-121, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat

DWR will restore and protect sufficient acres of suitable nesting habitat for short-eared owl and northern harrier such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 1:1. Restored habitat could consist of grassland or managed wetlands.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

***NEPA Effects*:** The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1B would not result in an adverse effect on short-eared owl or northern harrier.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1B would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of Plan Implementation on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to short-eared owl and northern harrier could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on short-eared owl and northern harrier.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce short-eared owl and northern harrier use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Tidal habitat restoration is unlikely to have an adverse effect on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for California least tern, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on short-eared owl and northern harrier with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* and AMM1–AMM7. Tidal habitat restoration is unlikely to have a significant impact on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1B implementation would result in a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 2,926–8,060 acres of modeled short-eared owl and northern harrier habitat (Table 12-1B-46).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 5,978 acres of modeled habitat (Table 12-1B-46), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in the *General Terrestrial Biology Effects* section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on mountain plover. Modeled habitat for mountain plover include grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1B-47. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would also benefit the mountain plover (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).

- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-47. Changes in Mountain Plover Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Wintering	2,962	2,962	4,528	4,528	NA	NA
Total Impacts CM1		**2,962**	**2,962**	**4,528**	**4,528**	**NA**	**NA**
CM2–CM18	Wintering	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**8,412**	**29,160**	**4,904**	**5,421**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 34,581 acres of modeled habitat for mountain plover (29,160 acres of permanent loss and 5,421 of temporary loss, Table 12-1B-47). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to loss of up to 7,490 acres of modeled mountain plover wintering habitat (2,962 acres of permanent loss, 4,528 acres of temporary loss) from CZ 4, CZ 5, CZ 6, CZ 7and CZ 8. The primary impact is from the construction of the canal and from the potential borrow and spoil areas on either side of the canal throughout the central Delta. The CM1 construction footprint does not overlap with any occurrences of mountain plover. However, the study area does overlap with the wintering range for the species and suitable habitat exists throughout the study area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled mountain plover wintering habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1B implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled mountain plover habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of mountain plover wintering habitat as part of tidal restoration and 1,489 acres of habitat as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide wintering habitat for mountain plover and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration*: Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of mountain plover habitat.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available mountain plover habitat. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled mountain plover habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural*

Community Restoration, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on mountain plover wintering in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand mountain plover wintering habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also modeled habitat for wintering mountain plover. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for mountain plover.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid an adverse effect of habitat loss from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on mountain plover habitat. Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for mountain plover. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of modeled mountain plover wintering habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential wintering habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of mountain plover habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the effects of habitat loss and potential for direct mortality on mountain plover under Alternative 1B would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on mountain plover. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential habitat for mountain plover wintering in the study area. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide habitat for mountain plover.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the significant impact of habitat loss resulting from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on mountain plover habitat. Implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would reduce the impact of near-term habitat loss to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of mountain plover habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on mountain plover would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on mountain plover.

Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide habitat for mountain plover such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

***NEPA Effects*:** New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines, would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on mountain plover.

***CEQA Conclusion*:** New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines, would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of Plan Implementation on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on mountain plover as a result of Alternative 1B implementation could have adverse effects on the species through the modification of habitat. With the With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 1B implementation would not have an adverse effect mountain plover.

***CEQA Conclusion*:** Indirect effects on mountain plover as a result of Alternative 1B implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 1B implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled mountain plover wintering habitat (Table 12-1B-47). Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 3,823 acres of modeled mountain plover habitat (Table 12-1B-47).

***NEPA Effects*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

***CEQA Conclusion*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would have a less-than-significant impact on mountain plover because birds would be expected to move to adjacent foraging habitat.

Black Tern

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of modeled habitat for black tern as indicated in Table 12-1B-48. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would also benefit the black tern (BDCP Chapter 3, *Conservation Strategy*).

- Protect 700 acres of cultivated lands, with at least 500 acres consisting of rice land, to expand upon and buffer newly restored/created nontidal perennial habitat in CZ 2, (Objective GGS2.3, associated with CM3).
- Protect up to 1,700 acres of rice land or equivalent habitat (e.g. perennial wetland) in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake. Any remaining acreage (from a total 2,740 acre commitment) will consist of rice land or equivalent-value habitat outside the Yolo Bypass in CZs 1, 2, 4, or 5 (Objective GGS3.1, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

As explained below, with the restoration and protection of these amounts of habitat, in addition to management activities that would enhance this habitat for the species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on black tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-48. Changes in Black Tern Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	306	490	1	1	791–1,582	0
Total Impacts CM2–CM18		**306**	**490**	**1**	**1**	**791–1,582**	**0**
TOTAL IMPACTS		**306**	**490**	**1**	**1**	**791–1,582**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

Alternative 1B conservation measures would result in the permanent loss of up to 491 acres of modeled nesting habitat for black tern, consisting of freshwater wetlands and rice in CZ 2 (Table 12-1B-48). Conservation measures that would result in these losses are Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), grassland restoration (CM8) and nontidal marsh restoration (CM10). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 31 acres of modeled black tern habitat in the Yolo Bypass in CZ 2. In addition, 1 acre of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1B implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 199 acres of modeled black tern habitat in CZ 2.
- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 52 acres of rice lands to grassland in CZ 2 by the late-long time period. An estimated 30 acres of impact would occur in the first 10 years.
- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10* would result in the permanent removal of 208 acres of black tern nesting habitat in in CZ 2. An estimated 46 acres would be removed in the first 10 years.

  CM11 Natural Communities Enhancement and Management: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could disturb nesting black terns if they were to nest in the vicinity of a worksite. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of black tern would be minimized with the implementation of and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect black tern nesting adjacent to maintenance areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged black tern individuals if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If

black tern were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of Mitigation Measure BIO-75.

- Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. This potential impact is further described under Impact BIO-129c below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to compensate for the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the nearterm protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored or protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to avoid an adverse effect on black tern from habitat loss, protection and restoration of 307 acres of rice and/or freshwater wetlands would need to occur in CZ 2 in the nearterm timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would be available to address this adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP and in order to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP and in order to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of black tern nesting habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. With habitat protection associated with CM3, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss under Alternative 1B would not be adverse under NEPA. Black tern is not a covered species under the BDCP and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction*

Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater weltands should be protected and 307 acres should be restored in CZ 2 to mitigate the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3 *Description of Alternatives*). These conservation actions are associated with CM3 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the nearterm protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored and protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2.

In order to compensate for black tern habitat loss, the protection and restoration of 307 acres of rice or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would reduce this potential impact to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Black tern is not a covered species under the BDCP and in order to have a less-than-significant impact on individuals, preconstruction would be required to ensure that nests are detected and avoided.

In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1-AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, which would require 1:1 protection of habitat in CZ 2 in the near-term time frame, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP and in order to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting terns during preconstruction surveys and ensure that active nests are avoided which would reduce the potential impact on nesting black tern to a less-than-significant level.

In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering these protection provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on black tern.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat

Because there is no near-term acreage commitment associated with the protection of rice and the restoration of freshwater wetlands in CZ 2, BDCP proponents must protect and restore rice and/or freshwater wetlands at a 1:1 ratio for each acre of habitat impacted in CZ 2.

Impact BIO-129b: Indirect Effects of Plan Implementation on Black Tern

If black terns were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting black terns. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants that could affect black terns in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including black tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on black tern.

Because of the uncertainty that exists at this programmatic level of review, there could be an effect on black tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of black tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce these impacts on a less-than–significant level.

Tidal habitat restoration could result in increased exposure of black tern to selenium which could result in potential mortality of a special-status species. These impacts would be significant. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With AMM27 in place, potential effects of increased exposure of black tern to selenium would be reduced to a less-than-significant impact.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass would inundate 791–1,582 acres of suitable black tern nesting habitat (land currently managed as rice in CZ 2). Inundation would occur during the nonbreeding season but could reduce the availability of nesting habitat during years that flooding extends into the nesting season (past March). Extended inundation of the Yolo Bypass would not be expected to affect black tern nesting habitat. However, if periodic inundation took land out of rice production, this could have an adverse effect on black tern nesting habitat. Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. The BDCP has committed to protect, restore and/or create up to 1,700 acres of rice in the Yolo Bypass (Objective GGS3.1). These acres of rice would be protected in areas that are less susceptible to inundation, which would benefit the black tern during years in which the magnitude and duration of inundation were increased.

NEPA Effects: Flooding of the Yolo Bypass is not expected to adversely affect nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production, it could also reduce suitable black tern nesting habitat. This potential effect would not be adverse with the creation and/or protection of 1,700 acres of rice in CZ 2 under BDCP Objective GGS3.1.

CEQA Conclusion: Flooding of the Yolo Bypass is not expected to have a significant impact on nesting habitat for black tern. However, if flooding were to significantly reduce rice production and reduce suitable black tern nesting habitat, this impact would be reduced to a less-than-significant level by the creation and/or protection of 1,700 acres of rice in CZ 2 under BDCP Objective GGS3.1.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of nest habitat in the Plan Area, which includes grassland, vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-1B-49. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would also benefit the California horned lark and the grasshopper sparrow (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-49. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	2,962	2,962	4,528	4,528	NA	NA
Total Impacts CM1		**2,962**	**2,962**	**4,528**	**4,528**	**NA**	**NA**
CM2–CM18	Breeding	5,450	26,198	376	893	777–2,423	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**777–2,423**	**3,823**
TOTAL IMPACTS		**8,412**	**29,160**	**4,904**	**5421**	**777–2,423**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 34,581 acres of modeled breeding habitat for California horned lark and grasshopper sparrow (29,160 acres of permanent loss and 5,421 acres of temporary loss; Table 12-1B-49). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 7,490 acres of modeled California horned lark and grasshopper sparrow habitat (2,962 acres of permanent loss, 4,528 acres of temporary loss) in CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8. Habitat losses would occur at various locations along the new canal route from the construction of the canal and the associated borrow and spoil sites and at the intake sites along the Sacramento River. Permanent and temporary losses of foraging habitat would also occur at the new forebay site just south of Clifton Court Forebay and associated borrow and spoil sites. Approximately 685 acres of impact would be from the new forebay constructed south of the Clifton Court Forebay in CZ 8. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 2 and 3 (6 occurrences), in the Stone Lakes NWR. However, the CM1 footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on California horned larks and grasshopper sparrows if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled California horned lark and grasshopper sparrow habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled California horned lark and grasshopper sparrow nesting habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of California horned lark and grasshopper sparrow nesting habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide nesting habitat for California horned lark and grasshopper sparrow and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of California horned lark and grasshopper sparrow nesting habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct*

Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would be available to address these adverse effects.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled California horned lark and grasshopper sparrow habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of

alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid an adverse effect of habitat loss from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on California horned lark and grasshopper sparrow habitat. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat,* would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for California horned lark and grasshopper sparrow. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) and would provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

***NEPA Effects*:** The loss of California horned lark and grasshopper sparrow habitat and potential for mortality of these special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the effects of habitat loss under Alternative 1B4 on California horned lark and grasshopper sparrow would not be adverse. California horned lark and grasshopper sparrow are not covered species under the BDCP and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the significant impact of habitat loss resulting from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on California horned lark and grasshopper sparrow habitat. Implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would reduce the impact of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of California horned lark and grasshopper sparrow habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid significant impacts on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide California horned lark and grasshopper sparrow habitat such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1 protection. Additional grassland protection, enhancement, and management may be substituted for the protection of cultivated lands.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. *AMM20 Greater Sandhill Crane* would minimize the risk of bird strikes by by requiring the installation of flight diverters on new and selected existing powerlines.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane* the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane*, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of Plan Implementation on California Horned Lark and Grasshopper Sparrow

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to California horned lark and grasshopper sparrow nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 1B implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. California horned lark and grasshopper sparrow are not covered species under the BDCP, and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 1B implementation could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on California Horned Lark and Grasshopper Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158-3,650 acres of modeled California horned lark and grasshopper sparrow habitat (Table 12-1B-49).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-1B-49).

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects**:** Periodic inundation of floodplains would not have adverse effects on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

CEQA Conclusion**:** Periodic inundation of floodplains would not have a significant impact on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis includes tidal freshwater emergent wetlands, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZs 2, 4, and 11.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1B-50. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would also benefit least bittern and white-faced ibis (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation ofAMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-50. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	6	6	5	5	NA	NA
Total Impacts CM1		**6**	**6**	**5**	**5**	**NA**	**NA**
CM2–CM18	Nesting	5,134	13,063	45	45	961–2,672	NA
Total Impacts CM2–CM18		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**
TOTAL IMPACTS		**5,140**	**13,069**	**50**	**50**	**961–2,672**	**NA**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 1B conservation measures would result in the combined permanent and temporary loss and conversion of up to 13,119 acres of modeled habitat for least bittern and white-faced ibis (13,069 acres of permanent loss and conversion and 50 of temporary loss, Table 12-1B-50). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass enhancements (CM2), and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 11 acres of modeled least bittern and white-faced ibis habitat (6 acre of permanent loss, 5 acres of temporary loss) from CZ 4.

Permanent losses would occur as a result of constructing the east canal. Small areas of emergent wetland and managed wetland would be removed where the canal would cross manmade channels. The temporary losses would also occur where small patches or stringers of wetlands would be removed for siphon construction. The construction footprint for CM1 does not overlap with any occurrences of least bittern or white-faced ibis. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address potential effects on least bittern or white-faced ibis if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 55 acres of modeled least bittern and white-faced ibis habitat in the Yolo Bypass in CZ 2. In addition, 45 acres of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 13,008 acres of modeled least bittern and white-faced ibis habitat in CZ 2, 4, and 11 by the late long-term time period.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7described below and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce potential effects.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,190 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,140 acres of permanent loss, and 50 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 11 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 11 acres of habitat should be restored and 11 acres of habitat should be protected to compensate for the CM1 losses of 11 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland and protecting and enhancing 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,119 acres (13,069 acres of permanent loss, 50 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

***NEPA Effects*:** The loss of least bittern and white-faced ibis habitat and potential mortality of these special status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with the habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss under on least bittern and white-faced ibis would not be adverse under Alternative 1B. Least bittern and white-faced ibis are not covered species under the BDCP, and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. The Plan would remove 5,190 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,140 acres of permanent loss, and 50 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 11 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 11 acres of habitat should be restored and 11 acres of habitat should be protected to compensate for the CM1 losses of 11 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal freshwater emergent wetland and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys would be required to ensure that nests were detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the potential impact on nesting least bittern and white-faced ibis to a less-than-significant impact.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,119 acres (13,069 acres of permanent loss, 50 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid having a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting least bittern and white-faced ibis and to a less-than-significant level.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters which would reduce bird strike risk of least bittern and white-faced ibis. ***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on least bittern and white-faced ibis.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of Plan Implementation on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to least bittern and white-faced ibis could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of other conservation actions. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

***CEQA Conclusion*:** Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of plan implementation would represent a substantial adverse effect in the absence of other conservation actions. This impact would be significant. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of plan implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other conservation measures. This would be a significant impact. With AMM1–AMM7, *AMM27 Selenium Management*, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 961-2,672 acres of modeled least bittern and white-faced ibis habitat (Table 12-1B-50). However, no adverse effects of increased inundation frequency on nesting habitat are expected because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types. Inundation would occur in the nonbreeding season and wetlands supporting habitat would not be expected to be affected by flood flows.

NEPA Effects: Periodic inundation of Yolo Bypass would not be expected to have adverse effects on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

CEQA Conclusion: Periodic inundation of Yolo Bypass would not be expected to have a significant impact on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

Loggerhead Shrike

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Construction and restoration associated with Alternative 1B would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-1B-51. Construction and restoration associated with Alternative 1B conservation measures would include the following biological objectives over the term of the BDCP which would also benefit loggerhead shrike (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation ofAMM1–AMM7 and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-51. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	2,962	2,962	4,528	4,528	NA	NA
	Low-value	2,626	2,626	5,236	5,236	NA	NA
Total Impacts CM1		**5,588**	**5,588**	**9,764**	**9,764**	**NA**	**NA**
CM2–CM18	High-value	5,151	25,252	165	633	894–2,460	3,470
	Low-value	1,874	17,353	0	526	1,227–1,858	4,375
Total Impacts CM2–CM18		**7,025**	**42,605**	**165**	**1,159**	**2,121–4,318**	**7,845**
Total High-value		**8,113**	**28,214**	**4,693**	**5,161**	**894–2,460**	**3,470**
Total Low-value		**4,500**	**19,979**	**5,236**	**5,762**	**1,227–1,858**	**4,375**
TOTAL IMPACTS		**12,613**	**48,193**	**9,929**	**10,923**	**2,121–4,318**	**7,845**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 1B conservation measures would result in the combined permanent loss or conversion and temporary loss of up to 59,116 acres of modeled habitat for loggerhead shrike (33,375 acres of which would be high-value habitat and 25,741 acres of which would be low-value habitat, Table 12-1B-51). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), natural communities enhancement and management (CM11) and construction of conservation hatcheries (CM18). The majority of habitat loss (33,244 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

CM1 Water Facilities and Operation: Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 15,172 acres of modeled loggerhead shrike habitat. This would be comprised of 7,490 acres of high-value habitat (2,962 permanent loss or conversion, 4,528 temporary loss or conversion) and 7,862 acres of low-value cultivated lands (2,626 permanent loss, 5,236 temporary loss) from CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8. Impacts would primarily occur from the construction of the new forebay and associated borrow and spoil area in CZ 8. Other habitat losses would occur as a result of construction of the canal and associated borrow and spoil areas, and from the construction of the intakes in the north Delta. The largest impact from CM1 on loggerhead shrike would occur in CZ 8, where there are larger stands of ruderal and herbaceous vegetation and California annual grassland, which provides high-value habitat for the species. Approximately 685 acres of impact would be from the new forebay constructed south of the Clifton Court Forebay in CZ 8. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Loggerhead shrikes nest in high abundance in in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). The CM1 footprint overlaps with six loggerhead shrike occurrences, all in CZ 8. The construction of the new forebay overlaps with five occurrences and there is one occurrence that overlaps with the footprint of a temporary transmission line. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on loggerhead shrikes if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of high-value loggerhead shrike habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 182 acres of low-value habitat would be removed (85 acres of permanent loss, 97 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 20,880 acres of high-value loggerhead shrike habitat and 12,364 acres of low-value habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration: Construction* of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of high-value loggerhead shrike habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of high-value loggerhead shrike habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration. In addition, 503 acres of low-value habitat would be removed as a part of tidal restoration and 1,971 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide habitat for loggerhead shrike and would result in the conversion of 1,849 acres of cultivated lands to high-value grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of high-value loggerhead shrike habitat and 735 acres of low-value loggerhead shrike habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Fences (e.g. barbed wire) installed as part of CM11 in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If the species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value loggerhead shrike habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. Hatchery construction is expected to occur within the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 9,761 acres (4,427 permanent, 5,333 temporary) of low-value habitat would be removed or converted in the near-term (CM1, 5,045 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4

in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable high-value crop types for loggerhead shrike to avoid an adverse effect of habitat loss from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on loggerhead shrike high-value habitat. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential effect from the loss of low-value loggerhead shrike foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the combined permanent of and temporary effects on 34,631 acres of high-value habitat and 25,741 acres of low-value loggerhead shrike habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of loggerhead shrike habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and AMM1– AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, and with implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss on loggerhead shrike under Alternative 1B would not be adverse. Loggerhead shrike is not a covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 13,316 acres (8,412 permanent, 4,904 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 9,761 acres (4,427 permanent, 5,333 temporary) of low-value habitat would be removed or converted in the near-term (CM1, 5,045 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable high-value crop types for loggerhead shrike to avoid the significant impact of habitat loss from CM1. The conservation commitment is 7,572 acres short of meeting the mitigation needed to compensate for other near-term effects on loggerhead shrike high-value habitat. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would address the significant impact of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

With the acres of habitat protection and restoration described above, in addition to Mitigation Measure BIO-138, *Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat*, Alternative 1B would not result in a substantial adverse effect through loss of high-value habitat. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential substantial impact from the loss of low-value loggerhead shrike foraging habitat. In addition, AMM1-AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid potentially significant impacts on nesting individuals. With these measures in place, Alternative 1B would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 1B would have a less-than-significant impact on loggerhead shrike.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 34,631 acres of high-value loggerhead shrike habitat during the term of the Plan. In addition, 21,047 acres of low-value loggerhead shrike habitat would be impacted. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on loggerhead shrike.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-138: Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat

Because the BDCP does not include acreage commitments for the protection of crop types in the near-term time period, DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa as high-value loggerhead shrike habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

***NEPA Effects*:** Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on loggerhead shrike.

***CEQA Conclusion*:** Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1B would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of Plan Implementation on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on loggerhead shrike as a result of Plan implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. The loggerhead shrike is not a covered species under the BDCP and the potential for mortality would be adverse without preconstruction surveys to ensure that nests are detected and avoided. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 1B implementation could have a significant impact on these species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on 1,830–5,646 acres of modeled loggerhead shrike habitat (consisting of approximately 777–2,423 acres of high-value habitat; Table 12-1B-51).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 8,138 acres of modeled habitat (Table 12-1B-51), consisting of 3,823 acres of high-value and 4,315 acres of low-value habitat.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would result in a less-than-significant impact on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

Song Sparrow "Modesto" Population

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on Modesto song sparrow. The Modesto song sparrow is common and ubiquitous throughout the study area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-1B-52. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would benefit Modesto song sparrow (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)
- Create 500 acres of managed wetlands in CZ 3, 4, 5, or 6 (Objectives GSHC1.3 and GSHC1.4, associated with CM10).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-52. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	74	74	72	72	NA	NA
Total Impacts CM1		**74**	**74**	**72**	**72**	**NA**	**NA**
CM2–CM18	Nesting	2,444	3,253	133	169	81–158	284
Total Impacts CM2–CM18		**2,444**	**3,253**	**133**	**169**	**81–158**	**284**
TOTAL IMPACTS		**2,518**	**3,327**	**205**	**241**	**81–158**	**284**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 3,568 acres of modeled habitat for Modesto song sparrow (of which 3,327 acres would be a permanent loss and 241 acres would be a temporary loss of habitat, Table 12-1B-52). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance and removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 146 acres of modeled Modesto song sparrow habitat (74 acres of permanent loss, 72 acres of temporary loss) from CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8. The permanent footprint for CM1 overlaps with 19 occurrences of Modesto song sparrow. Fourteen occurrences would be impacted by the construction of the canal, and the other impacts would occur from the forebay, potential borrow or spoil sites, siphon work areas, the permanent transmission line footprint, and a reusable tunnel material storage area. In addition, the temporary footprint overlaps with 42 occurrences of song sparrow. Thirty-six of these occurrences would be impacted by siphon work areas, two would be impacted by intake work areas, and the other 4 occurrences would be impacted by a tunnel work area. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Construction of the water conveyance facilities would occur within the first 10 years of Alternative 1B implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 143 acres of modeled Modesto song sparrow habitat in the Yolo Bypass in CZ 2. In addition, 133 acres of habitat would be temporarily removed. These losses would occur in the near-term timeframe and primarily consist of valley/foothill riparian natural community and managed wetland. The loss is expected to occur during the first 10 years of Alternative 1B implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated loss of 3,066 acres of modeled Modesto song sparrow habitat by the late long-term timeframe.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 80 acres of modeled Modesto song sparrow habitat (44 permanent, 36 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7. The BDCP is expected to restore approximately 5,000 acres of valley/foothill riparian natural community. These lands would be managed as a mosaic of seral stages, age classes, and plant heights, some of which would provide suitable nesting habitat for Modesto song sparrow.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP.

Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 2,723 acres of modeled habitat (2,518 permanent, 205 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 146 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 146 acres of suitable habitat should be restored/created and 146 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 8,850 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Modesto song sparrow.

The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Modesto song sparrow is not a covered species under the BDCP. For the BDCP avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 3,568 acres (3,327 acres of permanent loss, 241 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

***NEPA Effects*:** The loss of Modesto song sparrow habitat and potential for mortality of this special-status species under Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss on Modesto song sparrow under Alternative 1B would not be adverse. The Modesto song sparrow is not a covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 2,723 acres of modeled habitat (2,518 permanent, 205 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 146 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 146 acres of suitable habitat should be restored/created and 146 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 8,850 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding a significant impact of habitat loss on Modesto song sparrow.

The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1B as a whole would result in the permanent loss of and temporary effects on 3,658 acres (3,327 acres of permanent loss, 241 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to minimize direct mortality of individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

NEPA Effects: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

CEQA Conclusion: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow

Impact BIO-144: Indirect Effects of Plan Implementation on Modesto Song Sparrow

Indirect Construction-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on Modesto song sparrow.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Modesto song sparrow.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Modesto song sparrow from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 1B water conveyance facilities could adversely affect individuals in the absence of other conservation actions. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds s*, would minimize this adverse effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Modesto song sparrow, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Indirect effects on Modesto song sparrow as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. With the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 81-158 acres of modeled Modesto song sparrow habitat. However, inundation would occur during the nonbreeding season. Reduced foraging habitat availability would be expected during the fledgling period of the nesting season due to periodic inundation.

Based on hypothetical floodplain restoration, construction of setback levees from seasonally inundated floodplain restoration (CM5) could result in periodic inundation of up to approximately 284 acres of Modesto song sparrow modeled habitat (Table 12-1B-52).

The periodic inundation of the Yolo Bypass (CM2) and of seasonal floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat, but may reduce the availability of nesting habitat during years when flooding extends into the nesting season (after March).

***NEPA Effects*:** Periodic inundation would not result in an adverse effect on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that provide Modesto song sparrow habitat.

***CEQA Conclusion*:** Periodic inundation would have a less-than-significant impact on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that provide Modesto song sparrow habitat.

Bank Swallow

This section describes the effects of Alternative 1B, including construction and implementation of other conservation components, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70-90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Construction and restoration associated with Alternative 1B conservation measures would not result in the direct loss of modeled habitat for bank swallow (Table 12-1B-53). However, indirect effects of noise and visual disturbance resulting from *CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat.

As explained below, impacts on bank swallow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-1B-53. Changes in Bank Swallow Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Breeding	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities from *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration*, including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in CZ 2 and CZ 5, and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

NEPA Effects: Construction activities associated with habitat restoration could adversely affect bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in adverse effects on bank swallows if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this adverse effect.

CEQA Conclusion: Construction activities associated with habitat restoration could result in a significant impact on bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, BDCP proponents will not construct conservation components during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWR will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization.

Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the March when the swallows have nested and layed eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses that resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Chapter 5, Section 5.3.1, *Methods for Analysis*, for a description of the model). Alternative 1B would implement Operational Scenario A, which is the same Operational Scenario as Alternative 1A described below.

On the Sacramento River, at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 1A could increase between April and August in all but wet years at the Keswick flow gauge based on modeling assumptions (Table 1 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) and in dry and critical years at the gauge upstream of Red Bluff (Table 3 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) which could lead to inundation of active colonies. However, model outputs indicate that the flows under Existing Conditions and the predicted flows in the late long-term without the project (No Action Alternative) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (Table 15 in Section 11C.1.1 and Table 17 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). In addition, at the Verona gauge on the Sacramento River in average, above normal, and wet water years, flows are predicted to be greater than 14,000 cfs during some months of the breeding season, which could lead to bank collapse events (Tables 1, 3, and 7 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). However, flows of this height are recorded under Existing Conditions at this flow gauge and are also predicted for the late long-term time without the project (No Action Alternative).

***NEPA Effects*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1B would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of upstream impacts on bank swallow from changes in water facilities operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

***CEQA Conclusion*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1B would not differ substantially from than those under the Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitor ing[1] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would

[1] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

result inloss of active nest sites or degradation of available nesting habitat, and the extent to which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on yellow-headed blackbird. The habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. These natural communities support aquatic insects which are important prey items for yellow-headed blackbird young (Beedy 2008). Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-1B-54. Full implementation of Alternative 1B would include the following biological objectives over the term of the BDCP which would also benefit yellow-headed blackbird (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objective ASWNC1.1, Objective VPNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat (Table 12-1B-38) in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and implementation ofAMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-54. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 1B

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	19	19	35	35	NA	NA
	Foraging	2,964	2,964	4,582	4,582	NA	NA
Total Impacts CM1		**2,983**	**2,983**	**4,617**	**4,617**	**NA**	**NA**
CM2–CM18	Nesting	5,814	13,902	45	46	961–2,678	18
	Foraging	5,612	26,673	376	905	368–1,476	2,701
Total Impacts CM2–CM18		**11,426**	**40,575**	**421**	**951**	**1,495–4,394**	**2,719**
Total Nesting		**5,833**	**13,921**	**80**	**81**	**961–2,678**	**18**
Total Foraging		**8,576**	**29,637**	**4,958**	**5,487**	**368–1,476**	**2,701**
TOTAL IMPACTS		**14,409**	**43,558**	**5,038**	**5,568**	**1,495–4,394**	**2,719**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 49,126 acres of modeled habitat (14,002 acres of nesting habitat and 35,124 acres of foraging habitat)for yellow-headed blackbird (Table 12-1B-54). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B water conveyance facilities would result in the combined permanent and temporary loss of up to 54 acres of yellow-headed blackbird nesting habitat (19 acres of permanent loss and 35 acres of temporary loss). In addition, 7,546 acres of foraging habitat would be removed (2,964 acres of permanent loss, 4,582 acres of temporary loss) (Table 12-1B-54). Impacts from CM1 would occur in the central delta in CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for CM1. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on yellow-headed blackbirds if they were to nest in or adjacent to construction activities. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 100 acres of nesting habitat (55 acres of permanent loss, 45 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,144 acres of foraging habitat would be removed (879 acres of permanent loss, 265 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1B implementation.
- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation from CM4 would permanently remove or convert an estimated 13,847 acres of nesting habitat, which would consist primarily of managed wetland. In addition, 20,029 acres of foraging habitat would be lost or converted as a result of tidal restoration, over half of which would be from the loss or conversion of alfalfa. However, the resulting 65,000 acres of tidal natural communities would also provide habitat for the species, 24,000 acres of which would be tidal freshwater natural communities providing breeding habitat for yellow-headed blackbird.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 2 acres of yellow-headed blackbird nesting habitat (1 acres of permanent loss, 1 acres of temporary loss) and 1,641 acres of foraging habitat (1,051 acres of permanent loss, 590 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1B implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 509 acres of yellow-headed blackbird foraging habitat as part of tidal restoration and 2,033 acres as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 926 acres of yellow-headed blackbird agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of foraging habitat value.CM8 would result in the restoration of 2,000 acres of grassland foraging habitat in the study area.

- *CM10 Nontidal Marsh Restoration:* Restoration and creation of nontidal freshwater marsh (CM10) would result in the permanent conversion of 988 acres of cultivated lands foraging habitat to nontidal marsh in CZ 2 and CZ 4. Yellow-headed blackbird nesting habitat may develop along the margins of restored nontidal marsh and restoration would also provide foraging habitat for the species.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by AMM1–AMM7. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-yellow-headed blackbird foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 5,913 acres (5,833 acres of permanent loss, 80 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 54 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 13,534 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 7,546 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 54 acres of nesting habitat should be restored/created and 54 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 7,546 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,948 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 35,124 acres of foraging habitat (11% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (Table 3.3-6 in BDCP Chapter 3). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of yellow-headed blackbird habitat and potential for direct mortality of this special-status species associated with Alternative 1B would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM8, CM10, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction phase, the effects of habitat loss would not be adverse under Alternative 1B. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. The Plan would remove 5,913 acres (5,833 acres of permanent loss, 80 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 54 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 13,534 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 7,546 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 54 acres of nesting habitat should be restored/created and 54 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 7,546 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures. With the acres of habitat protection and restoration described above, in addition to AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, Alternative 1B would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 1B would have a less-than-significant impact on yellow-headed blackbird.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 13,948 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 35,124 acres of foraging habitat (11% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (Table 3.3-6 in BDCP Chapter 3). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1B's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts necessary to compensate for habitat lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would reduce the potential for yellow-headed blackbird collision with transmission lines. Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1B would not result in an adverse effect on yellow-headed blackbird.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 1B would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of Plan Implementation on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1B restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-headed blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-headed blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury, in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** In the absence of other conservation actions, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1B would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased exposure to selenium would be less than significant.

Indirect effects of plan implementation would represent an adverse effect on yellow-headed blackbird in the absence of other conservation measures. This would be a significant impact. With AMM1–AMM7, AMM27, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of plan implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 961–2,678 acres of nesting habitat and 368–2,678 acres of foraging habitat (Table 12-1B-54). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 18 acres of nesting habitat and 2,701 acres of nonbreeding habitat (Table 12-1B-54) resulting in the temporary loss of these habitats. Foraging yellow-headed blackbirds would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would not have an adverse effect on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat may be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat would be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-1B-55. Full implementation of Alternative 1B would also include biological objectives over the term of the BDCP to benefit the riparian brush rabbit (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian brush rabbit, with conservation principles involves protecting, restoring or creating, and maintaining habitat and corridors near the largest remaining fragments of habitat and extant populations; providing high-water refugia from flooding; and managing feral predators (dogs and cats) in areas occupied by the species. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5, CM7, and CM11).

- Of the 750 acres of protected valley/foothill riparian natural community protected under Objective VFRNC1.2, protect at least 200 acres of suitable riparian brush rabbit habitat (defined in CM7 Riparian Natural Community Restoration) that is occupied by the species or contiguous with occupied habitat (Objective RBR1.1, associated with 3).

- Of the 1,000 acres of early- to midsuccessional riparian habitat maintained under VFRNC2.2, maintain at least 800 acres within the range of the riparian brush rabbit (CZ 7), in areas that are adjacent to or that facilitate connectivity with occupied or potentially occupied habitat (Objective RBR1.2, associated with CM3, CM7, and CM11).

- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain at least 300 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Objective 1.3, associated with CM3, CM7, and CM11).

- Create and maintain high-water refugia in the 300 acres of restored riparian brush rabbit habitat and the 200 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Objective RBR1.4, associated with CM7 and CM11).

- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Objective RBR1.5, associated with CM11).

- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres of grasslands restored under Objective GNC1.2, protect or restore grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6, associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-55. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	5	5	5	5	NA	NA
	Grassland	137	137	30	30	NA	NA
Total Impacts CM1		**142**	**142**	**35**	**35**	**NA**	**NA**
CM2–CM18	Riparian	0	62	0	35	0	264
	Grassland	0	44	0	20	0	423
Total Impacts CM2–CM18		**0**	**106**	**0**	**55**	**0**	**687**
TOTAL IMPACTS		**142**	**248**	**35**	**90**	**0**	**687**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 1B conservation measures would result in the permanent loss of up to 107 acres of riparian habitat and 231 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-1B-55). The hypothetical footprint for levee construction under CM5, overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange. Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 1B water conveyance facilities would result in the permanent removal of approximately 5 acres of riparian habitat and 137 acres of associated grassland habitat and in the temporary removal of 5 acres of riparian habitat and 30 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-1B-55). The riparian habitat that would be removed is of low value for the riparian brush rabbit as is consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (BDCP Appendix 3.E, *Conservation*

Principles for the Riparian Brush Rabbit and Riparian Woodrat). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 19 acres of riparian habitat and 18 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. The riparian habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by agricultural lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. The habitat that would be removed is not adjacent to any exiting conserved lands, and is several miles north and northeast of the northernmost riparian brush rabbit record located northeast of Paradise Cut (Williams et al. 2002). Although the final footprint for tidal natural communities restoration would differ from the hypothetical footprint, *AMM25 Riparian Woodrat and Riparian Brush Rabbit* requires that tidal natural communities restoration avoid removal of any habitat occupied by the riparian brush rabbit.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 43 acres of riparian habitat and 26 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late longterm. Levee construction would also result in the temporary removal of 35 acre riparian habitat and 20 acres of grassland habitat for the riparian brush rabbit. Although the effects are considered temporary, five years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected. The value of this habitat for riparian brush rabbit is high: although it consists of small patches and narrow bands of riparian vegetation, these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange.

  Although the final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis, restoration of the river floodplain in CZ 7 would be targeted in the general area of the riparian brush rabbit population. Implementation of adaptive management described in AMM25 would ensure that riparian brush rabbit habitat permanently removed does not exceed maximum allowable habitat loss for this species.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

  Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37, Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.

- Operations and maintenance: Ongoing maintenance of BDCP facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.
- Injury and direct mortality: Water conveyance facility construction is not likely to result in injury or mortality of individual riparian brush rabbits because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian brush rabbit because tidal natural communities restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian brush rabbits: however, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction (AMM25).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1B would result in permanent and temporary effects combined on 10 acres of riparian habitat and 167 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would occur be an area unlikely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 10 acres of riparian habitat should be restored, 10 acres of riparian habitat should be protected, and 334 acres of grassland should be protected for riparian brush rabbit for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1–RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 10 acres of riparian habitat restored, 10 acres of riparian habitat protected, and 334 acres of grassland protected.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM*6 *Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, and *AMM37 Recreation*. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1B a whole would result in permanent and temporary effects combined on 107 acres of modeled riparian habitat and 231 acres of modeled grassland habitat for riparian brush rabbit, representing 4% and 8% of the riparian and grassland modeled habitat in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (Objective RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the Plan would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

NEPA Effects: In the near-term, the loss of riparian brush rabbit habitat under Alternative 1B would not be adverse because there is little likelihood of riparian brush rabbits being present and the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of riparian brush rabbit riparian and grassland habitat associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM25, and AMM37, the effects of Alternative 1B as a whole on riparian brush rabbit would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 1B would result in permanent and temporary effects combined on 10 acres of riparian habitat and 167 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would occur be an area unlikely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 10 acres of riparian habitat should be restored, 10 acres of riparian habitat should be protected, and 334 acres of grassland should be protected for riparian brush rabbit for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian(Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2)with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1-RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 10 acres or riparian habitat protected, 10 acres of riparian habitat restored, and 334 acres of grassland habitat

The plan also contains commitments to implement AMM1–AMM7, AMM10, AMM25, and AMM37. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1B would result in permanent and temporary effects combined on 105 acres of modeled riparian habitat and 244 acres of modeled grassland habitat for riparian brush rabbit in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

Only a small proportion of the habitat losses would be considered occupied and of high value. The Alternative 1B conservation measures provide for large acreages of riparian brush rabbit riparian and grassland habitats to be protected and restored, and the BDCP includes AMM1–AMM7, AMM10, AMM25, and AMM37, which are directed at minimizing or avoiding potential effects during construction and operation of the conservation measures. Overall, the BDCP would provide a substantial net benefit to the riparian brush rabbit through the increase in available habitat and habitat in protected status. These protected areas would be managed and monitored to support the species.

Considering the habitat restoration and protection associated with CM3, CM7, CM8 and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the temporary and permanent losses of riparian and grassland habitat and potential for direct mortality of riparian brush rabbit as a result of implementing Alternative 1B would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. The loss of habitat and potential mortality of riparian brush rabbits would not be a significant impact under CEQA.

Impact BIO-153: Indirect Effects of Plan Implementation on Riparian Brush Rabbit

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and associated grassland habitat in the study area. These construction activities would include water conveyance construction, tidal natural communities restoration construction, construction and subsequent maintenance of transmission lines, and construction of setback levees. Construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. Tidal natural communities restoration construction would potentially affect adjacent riparian habitat and associated grassland habitat for this species: however, adverse effects on the species are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian brush rabbit. The activity most likely to result in noise, lighting, and visual disturbances to riparian brush rabbit is the construction of setback levees for floodplain restoration, which would take place in CZ 7, where the species is known to occur. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1B would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 1B would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise, lighting, and visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 1B, the BDCP would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 1B would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian brush rabbit habitat. This activity would periodically inundate approximately 264 acres of riparian habitat (9% of riparian habitat in the Plan Area) and 423 acres of associated grassland habitat (14% of associated grassland habitat in the Plan Area) for the riparian brush rabbit. The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of high-value habitat for the species: although they consist of small patches and narrow bands of riparian vegetation, many of these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The restored floodplain would include a range of elevations from lower lying areas that flood frequently (e.g., every 1 to 2 years) to higher elevation areas that flood infrequently (e.g., every 10 years or more).

Seasonal flooding in restored floodplains can result in injury or mortality of individuals if riparian brush rabbits occupy these areas and cannot escape flood waters. One recorded occurrence of riparian brush rabbit (Williams et al. 2002), just west of Stewart Road in Mossdale, is in the area that would be seasonally flooded based on the hypothetical restoration footprint.

***NEPA Effects*:** Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1B, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, Alternative 1B would not adversely affect the species.

***CEQA Conclusion*:** Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The overall effect of seasonal inundation on existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for covered riparian species, such as the riparian brush rabbit. Long-term management of riparian areas would ensure that refugia also exist along the edges of seasonally inundated habitat.

The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1B, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Periodic inundation of riparian and grassland habitat for riparian brush rabbit under Alternative 1B would have a less-than-significant impact on the species.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the BDCP area in CZ 7, south of SR 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams and Basey 1986:1–112; 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop. Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of riparian woodrat modeled habitat as indicated in Table 12-1B-56. Tidal habitat restoration, floodplain restoration, and protection and management of natural communities could affect modeled riparian woodrat habitat. However, because the species is not known to occur in the study area it is not expected to be affected by BDCP actions unless the species were to establish in the study area over the term of the BDCP. Full implementation of Alternative 1B would also include biological objectives over the term of the BDCP to benefit the riparian woodrat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian woodrat involves providing opportunities for population expansion into the Plan Area from adjacent lands to the south and southeast. The strategy focuses on restoring and maintaining suitable habitat at the southernmost end of CZ 7, providing connectivity with existing populations to the south and southeast, and creating and maintaining flood refugia. This conservation approach is consistent with the recovery plan (U.S. Fish and Wildlife Service 1998) and conservation principles (BDCP Appendix 3.E). The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM5, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain 300 acres riparian habitat in CZ 7 that meets the ecological requirements of the riparian woodrat (i.e., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat (Objective RW1.1, associated with CM3, CM7, CM11).
- Provide and maintain high-water refugia in the 300 acres of riparian woodrat habitat restored under Objective RW1.1 through the retention, construction, and/or restoration of high-ground

habitat on mounds, berms, or levees, so that refugia are no further apart than 67 feet (Objective RW1.2, associated with CM7 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian woodrat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-56. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	0	0	1	1	NA	NA
Total Impacts CM1		**0**	**0**	**1**	**1**	**NA**	**NA**
CM2–CM18	Riparian	0	51	0	33	0	203
Total Impacts CM2–CM18		**0**	**51**	**0**	**33**	**0**	**203**
TOTAL IMPACTS		**0**	**51**	**1**	**34**	**0**	**203**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

- Alternative 1B conservation measures would result in the permanent loss of up to 51 acres of habitat (2% of the habitat in the study area) and temporary loss of up to 34 acres of habitat for riparian woodrat (Table 12-1B-56). Construction of Alternative 1B water conveyance facilities (CM1), tidal natural communities restoration (CM4) and seasonally inundated floodplain restoration (CM5) would remove habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions *CM1 Water Facilities and Operation*: Development of Alternative 1B water conveyance facilities would result in the temporary removal of approximately 1 acre of modeled habitat for riparian woodrat in CZ 8 (Table 12-1B-56). The modeled habitat that would be removed is of low value for the riparian woodrat as is consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. Trapping efforts conducted for the riparian woodrat in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled habitat for the riparian woodrat in CZ 7. This habitat is of low value, consisting of a small, isolated patch surrounded by agricultural lands, and the species has a relatively low likelihood of being present in these areas. The measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian woodrat as determined by presence/absence surveys. Because the estimates of habitat loss due to tidal inundation are based on projections of where restoration may occur, actual habitat loss is expected to be lower because sites would be selected to minimize effects on riparian woodrat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 41 acres of modeled habitat for the riparian woodrat in CZ 7. The value of this habitat for riparian woodrat is moderate. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River. There are two species occurrences immediately south of CZ 7, one of which is less than 1.5 mile from the southernmost patch of riparian habitat potentially affected by levee construction.

  The final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis. However, monitoring and adaptive management described in CM11 and AMM25 would ensure that modeled habitat permanently removed does not exceed the amount estimated based on the hypothetical footprint. Habitat loss is expected to be lower than 41 acres because sites would be selected and restoration designed to minimize effects on the riparian woodrat. If natural flooding is insufficient to maintain appropriate riparian woodrat vegetation structure, the vegetation would be actively managed to provide suitable habitat structure as described in CM11 Natural Communities Enhancement and Management.

  Levee construction would also result in the temporary removal of 33 acres of modeled habitat for the riparian woodrat. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian woodrat habitat. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian woodrat habitat and are expected to result in overall improvements to and maintenance of riparian woodrat habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: The only ongoing effects on the riparian woodrat are those potentially resulting from habitat enhancement and management activities. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities may result in harassment of riparian woodrats through noise and visual disturbance which would be minimized with implementation of AMM1–AMM7, AMM10, and AMM25.

- Injury and direct mortality: Water conveyance facility construction is not likely to result in injury or mortality of individual riparian woodrats because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian woodrats because tidal natural communities restoration projects would be designed to avoid occupied riparian woodrat habitat and if that is not possible to trap and relocate the species (AMM25). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats: however, preconstruction surveys, construction monitoring, and other measures would be implemented under AMM25 to avoid and minimize injury or mortality of this species during construction, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. If occupied riparian woodrat habitat cannot be avoided, mortality would be avoided through implementation of a trapping and relocation program. The program would be developed in coordination with USFWS, and relocation would be to a site approved by USFWS prior to construction activities.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Alternative 1B would result in temporary effects on 1 acre of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction in CZ 8, and would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 1 acre of riparian habitat should be restored and 1 acre of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would not be adverse under NEPA, because only 1 acre of modeled habitat would be temporarily affected and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 1B as a whole would result in the permanent loss of and temporary removal of 85 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

The BDCP would restore at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (*CM3*) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 1B conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

NEPA Effects: Alternative 1B would provide a substantial benefit to the riparian woodrat through the net increase of available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The habitat that would be affected by Alternative 1B is currently unoccupied, and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals under Alternative 1B would not have an adverse effect on riparian woodrat.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes.

Alternative 1B would result in temporary effects on 1 acre s of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction, and would occur in CZ 8 in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical CEQA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 1 acre of riparian habitat should be restored and 1 acre of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would not be significant under CEQA, because only 1 acre of modeled habitat would be temporarily affected and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to AMM1–AMM7, AMM10, and AMM25. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 1B as a whole would result in the permanent loss of and temporary removal of 85 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

The BDCP would restore at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (*CM3*) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 1B conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

Alternative 1B would provide a substantial benefit to the riparian woodrat through the net increase of available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The habitat that would be affected by Alternative 1B is currently unoccupied, and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals under Alternative 1B would not have a significant impact on riparian woodrat.

Impact BIO-156: Indirect Effects of Plan Implementation on Riparian Woodrat

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled habitat for riparian woodrat. These effects are related construction activities associated with water conveyance construction, tidal natural community restoration construction, and construction of setback levees. Indirect effects on the species from construction associated with tidal natural community restoration are unlikely because tidal natural community restoration projects would be sited to avoid areas occupied by riparian woodrat. The activity most likely to result in noise, lighting, and visual disturbances to riparian woodrat is the construction of setback levees.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1B would avoid the potential for substantial adverse effects on riparian woodrats, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Therefore, indirect effects of Alternative 1B would not have an adverse effect on riparian woodrat.

CEQA Conclusion: Should the species be detected in the study area, indirect effects of conservation measure construction and implementation could impact riparian woodrat and its habitat. AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian woodrat habitat. Floodplain restoration would result in periodic inundation of up to 203 acres of riparian woodrat habitat (9% of the riparian woodrat habitat in the Plan Area). The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of moderate-value habitat for the species. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River and there are two species occurrences immediately south of CZ 7, one of which is less than 1 mile from the southernmost patch of riparian habitat potentially affected by levee construction. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more).

NEPA Effects: Alternative 1B's period inundation of 203 acres of riparian habitat for riparian woodrat is not expected to result in substantial adverse effects on riparian woodrat, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrat. The effects of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation. Therefore, the periodic inundation of riparian woodrat habitat would not adversely affect the species Alternative 1B.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect a total of 203 acres of riparian habitat for riparian woodrat, representing 9% of the 2,166 acres of modeled riparian woodrat habitat in the study area. The impact of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation, as described in AMM25. Implementation of CM5 would not be expected to result in significant impacts on riparian woodrat, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Periodic inundation of riparian woodrat habitat under Alternative 1B would have a less-than-significant impact.

Salt Marsh Harvest Mouse

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on the salt marsh harvest mouse. The habitat model used to assess effects for the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Construction and restoration associated with Alternative 1B conservation measures would result in effects on modeled salt marsh harvest mouse habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-1B-57. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit salt marsh harvest mouse (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary salt marsh harvest mouse habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect and enhance at least at least 1,500 acres of managed wetland in Grizzly Island Marsh Complex for the benefit of salt marsh harvest mouse (Objective MWNC1.1, associated with CM3).
- Protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3 and CM8).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of restored or created middle and high marsh as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective SMHM1.1).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of managed wetland protected and enhanced in the Grizzly Island Marsh Complex as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California, and increase population levels above the current baseline (Objective SMHM1.2).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs to minimize potential effects, impacts on the salt marsh harvest mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-57. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	TBEW Primary	64	67	0	0	0	0
	TBEW Secondary	0	0	0	0	0	0
	Upland Secondary	8	9	0	0	0	0
	MW Wetland Primary	1,913	5,323	0	0	0	0
	MW Wetland Secondary	315	807	0	0	0	0
	MW Upland	165	762	0	0	0	0
Total Impacts CM2–CM18		**2,465**	**6,968**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**2,645**	**6,968**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
TBEW = tidal brackish emergent wetland
MW = managed wetland
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

Alternative 1B tidal restoration (CM4) would be the only conservation measure resulting in effects on salt marsh harvest mouse habitat. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 6,968 acres of salt marsh harvest mouse modeled habitat, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. Salt marsh harvest mouse may be displaced temporarily from areas of converted habitat but these areas would ultimately provide suitable habitat for the species. However, 1,058 of these acres would be downgraded from primary habitat (67 acres of primary tidal brackish emergent wetland and 991 acres of primary managed wetland) to secondary tidal brackish emergent wetland. The hypothetical restoration footprints in Suisun Marsh overlap with 13 CNDDB records for salt marsh harvest mouse (California Department of Fish and Wildlife 2013); however, the BDCP's conservation actions assume that all suitable habitat in Suisun Marsh is occupied by the species.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 1,500 acres of tidal brackish emergent wetland would be managed to provide viable habitat for salt marsh harvest mouse and the protection of 1,500 acres of managed wetland specifically to be managed for salt marsh harvest mouse. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas for salt marsh harvest mouse and may result in localized ground disturbances that could temporarily remove small amounts of salt marsh harvest mouse habitat. The restoration of tidal brackish emergent wetlands, the protection managed wetlands, and the protection and/or restoration of grasslands within 200 feet of restored salt marsh harvest mouse habitat would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of salt marsh harvest mouse habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to salt marsh harvest mouse during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1B would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be from primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan, because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under Alternative 1B would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- Restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs. This phasing would ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level impacts on salt marsh harvest mouse from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work

areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1B as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. These effects (loss and conversion) would be to 20% of the modeled habitat in the study area. Most of these effects (99%) would be to managed wetlands, which though are known to be occupied by salt marsh harvest mouse are at high risk of catastrophic flooding and have a lower long-term conservation value than tidal wetlands (U.S. Fish and Wildlife Service 2010). Effects on up to 20% of the species' habitat in the Plan Area may diminish the salt marsh harvest mouse population in the Plan Area and result in reduced genetic diversity, thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas.

The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (Objectives SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (Objective GNC1.4, associated with). Other factors relevant to effects on salt marsh harvest mouse are listed here.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan. Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

NEPA Effects: In the absence of other conservation actions, the effects on salt marsh harvest mouse habitat from Alternative 1B in the near-term would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of salt marsh harvest mouse habitat and potential mortality of individuals under Alternative 1B would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of near-term covered activities would be less than significant under CEQA. Alternative 1B would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be to primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under Alternative 1B would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- To ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level impacts on salt marsh harvest mouse from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1B would be less than significant.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1B as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (Objectives SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

Alternative 1B would result in substantial modifications to salt marsh harvest mouse habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the time period of construction, Alternative 1B over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on salt marsh harvest mouse.

Impact BIO-159: Indirect Effects of Plan Implementation on Salt Marsh Harvest Mouse

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to salt marsh harvest mouse occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on salt marsh harvest mouse.

Tidal marsh restoration has the potential to increase salt marsh harvests mouse's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High tidal marsh is considered to be primary habitat for salt marsh harvest mouse and thus the species could be exposed to methyl mercury in tidal restoration areas. Salt marsh harvest mouse may be exposed to elemental mercury by feeding on pickleweed, which is found concentrated in the distal tips of pickleweed leaves (Yee et. al., 2008). Though elemental mercury is less bioavailable than methylmercury, studies have shown that mercury can become methylated in the anaerobic portions of the intestinal tract (Rudd et al. 1980, Rieder et al. 2013) and could thus become a pathway for salt marsh harvest exposure to methylmercury. A study of small mammals residing in pickleweed around the San Francisco Bay showed an absence of salt marsh harvest mouse where mercury concentrations measured in house mice (*Mus musculus*) livers were ≥0.19 µg/g (dry weight) (Clark et al. 1992). Clark et al (1992) also report that the lack of salt marsh harvest mouse at these locations are not the result of undetected habitat differences or are by chance. Clarke et al (1992) suggest that the absence of salt marsh harvest mouse at certain locations may be associated with higher amounts of mercury and polychlorinated biphenyls (PCBs); however, because their study didn't analyze contaminants in salt marsh harvest mouse and because (at that time) there was no data in the literature on contaminants in harvest mice, they could not make conclusions on these associations. Currently, it is unknown what the exact exposure pathways are or what tissue concentrations are harmful to the salt marsh harvest mouse.

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for salt marsh harvest mouse exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on salt marsh harvest mouse resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1B would avoid and minimize indirect effects on salt marsh harvest mouse. These AMMs would also avoid and minimize effects that could substantially reduce the number of salt marsh harvest mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on salt marsh harvest mouse.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact salt marsh harvest mouse within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment adjacent to salt marsh harvest mouse habitat could also impact the species. With implementation of AMM1–AMM5 and AMM26 as part of Alternative 1B construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on salt marsh harvest mouse, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse. The indirect effects of Alternative 1B would have a less-than-significant impact on salt marsh harvest mouse.

Salt marsh harvest mouse could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse, and, therefore, would have a less-than-significant impact on the species.

Suisun Shrew

Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model. Construction and restoration associated with Alternative 1B would also include the following conservation actions over the term of the BDCP to benefit Suisun shrew (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary Suisun shrew habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect or restore grasslands adjacent t restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area, which provides refugia during high tides (Objective GNC1.4, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, impacts on the Suisun shrew would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-58. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	58	60	0	0	0	0
	Secondary	47	342	0	0	0	0
Total Impacts CM2–CM18		**105**	**401**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**105**	**401**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun shrew

BDCP tidal restoration (CM4) would be the only conservation measure resulting in loss of habitat to Suisun shrew. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 401 acres of Suisun shrew modeled habitat, which would include 377 acres of permanent losses and 24 acres of habitat conversions. Suisun shrew may be displaced temporarily from areas of converted habitat but would ultimately provide suitable habitat for the species. However, all 9 acres would be converted from secondary to primary habitat and therefore over would be net benefit to the species. The hypothetical restoration footprints overlap with two CNDDB records for Suisun shrew (California Department of Fish and Wildlife 2013).

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 6,000 acres of tidal brackish emergent wetland would be managed to provide habitat for covered species, including Suisun shrew. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas may result in localized ground disturbances that could temporarily remove small amounts of Suisun shrew habitat. The areas of grasslands that would be protected and/or restored within 200 feet of restored tidal marsh would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of

nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of Suisun shrew habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to Suisun shrew during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMM described below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. Alternative 1B would affect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects on Suisun shrew.

Other factors relevant to effects on Suisun shrew.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near-term (2,000 acres) would greatly exceed the amount permanently lost (105 acres).

Because there would be no project-level impacts on Suisun shrew resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1B as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet of this area would benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed here.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

NEPA Effects: In the absence of other conservation actions, the effects on Suisun shrew habitat from Alternative 1B would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by biological goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of Suisun shrew habitat and potential mortality of individuals in both the near-term and the late long-term under Alternative 1B would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of near-term covered activities would be less than significant under CEQA. Alternative

1B would impact 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects on Suisun shrew.

Other factors relevant to effects on Suisun shrew.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there would be no project-level impacts on Suisun shrew resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level CEQA analyses.

The Plan also includes commitments to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1B as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet of this area would benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed here.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

Alternative 1B would result in substantial modifications to Suisun shrew habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8 and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction phase, Alternative 1B over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on Suisun shrew.

Impact BIO-161: Indirect Effects of Plan Implementation on Suisun Shrew

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to Suisun shrew occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect Suisun shrew and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on Suisun shrew.

Tidal marsh restoration has the potential to increase Suisun shrew's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High and mid tidal marsh is considered to be primary habitat for Suisun shrew and thus the species could be exposed to methylmercury in tidal restoration areas. Suisun shrew could be exposed to methylmercury by feeding on marsh invertebrates that may bioaccumulate methylmercury from marsh sediments. Toxic concentrations of methylmercury have been found in the kidneys of shrews that inhabit contaminated sites and forage on earthworms and other prey that live within contaminated sediments (Talmage and Walton 1993; Hinton and Veiga 2002).

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for Suisun shrew exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on Suisun shrew resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1B would avoid and minimize the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of Suisun shrew, or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on Suisun shrew.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact Suisun shrew within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact Suisun shrew and its habitat. The inadvertent discharge of sediment adjacent to Suisun shrew habitat could also impact the species. With implementation of AMM1–AMM5 and AMM26 as part of Alternative 1B construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew. The indirect effects of Alternative 1B would have a less-than-significant impact on Suisun shrew.

Suisun shrew could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew, and, therefore, would have a less-than-significant impact on the species.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10. The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013) reports twelve occurrences of San Joaquin kit foxes along the extreme western edge of the Plan Area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife

2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-1B-59). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin kit fox habitat and potential American badger habitat. Full implementation of Alternative 1B would also include biological objectives over the term of the BDCP to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that kit fox may reside and breed in the Plan Area; and providing connectivity to habitat outside the Plan Area. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in CZ 1, CZ 8, and/or CZ 11 (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration) (Objective VPNC1.2, associated with CM3 and CM9).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.4, associated with CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.4, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.5, associated with CM11).

- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-59. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	172	172	165	165	NA	NA
Total Impacts CM1		**172**	**172**	**165**	**165**		
CM2–CM18	Grassland	3	8	0	0	0	0
Total Impacts CM2–CM18		**3**	**8**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**175**	**180**	**165**	**165**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 1B conservation measures would result in the permanent and temporary loss combined of 345 acres of modeled habitat for the San Joaquin kit fox (Table 12-1B-59). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects on are anticipated to be the same as those described for San Joaquin kit fox. Construction of Alternative 1B water conveyance facilities (CM1) and recreation facilities (CM11) would remove habitat. Habitat enhancement and management activities (CM11) could result in local adverse effects on species. In addition, construction vehicle activity could cause injury or mortality of San Joaquin kit foxes and badgers. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 172 acres and the temporary loss of 165 acres of modeled San Joaquin kit fox habitat and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8.

- *CM11 Natural Communities Enhancement and Managemen*t: The creation of recreational trails and recreational staging areas would result in the permanent removal of 8 acres of San Joaquin kit fox modeled habitat and American badger potential habitat. AMM24 would be implemented to ensure that San Joaquin kit fox dens are avoided, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Mitigation Measure BIO-162*: Conduct Preconstruction Survey for American Badger* would be implemented to ensure that American badger dens are avoided.

  Passive recreation in the reserve system could result in disturbance of San Joaquin kit foxes and American badgers at their den site. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox and American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox populations. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

  The BDCP would require the protection of grasslands in large patch sizes connected to existing large areas of grassland, habitat corridors and transition habitat areas to improve the ecological functions of the grasslands necessary to support the San Joaquin kit fox. American badger is expected to benefit in a similar fashion.

  The BDCP would require the enhancement and management of these protected existing grasslands and restored grasslands to improve their function as a natural community of plants and wildlife and for associated covered species, including San Joaquin kit fox and American badger. The BDCP also includes actions to improve rodent prey availability.

  However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs and mitigation measures listed below. These AMMs and mitigation measures would remain in effect throughout the BDCP's construction phase.

- Operations and maintenance: Ongoing maintenance of BDCP facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

- Injury and direct mortality: Water conveyance facility construction may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, AMM24, and AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Under Alternative 1B there would be a loss of 340 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (337 acres) and CM11 (3 acres). Typical NEPA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 680 acres of grassland should be protected for San Joaquin kit fox to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 680 acres of grassland protected.

The effects on San Joaquin kit fox and American badger habitat from Alternative 1B as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with habitat protection, restoration associated, and management and enhancement with CM3, CM8, and CM11 in addition to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation,* the effects of Alternative 1B on San Joaquin kit fox and American badger would not be adverse under NEPA. The AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 345 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing 6% of the modeled habitat.

With full implementation of the BDCP, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for both species.

Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1) and to other adjoining San Joaquin kit fox habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A, *Covered Species Accounts*). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP. Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, and Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

NEPA Effects: In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1B would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*, the effects of Alternative 1B as a whole on San Joaquin kit fox and American badger would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposed.

Under Alternative 1B there would be a loss of 340 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (337 acres) and CM11 (3 acres). Typical CEQA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 680 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on San Joaquin kit fox and American badger. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for San Joaquin kit fox and the mitigation measure for American badger satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM24, and AMM37 which include elements that avoid or minimize the risk of construction activity impacting habitat and species adjacent to work areas. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B on San Joaquin kit fox and American badger would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 680 acres of grassland protected.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 345 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing 6% of the modeled habitat.

With full implementation of Alternative 1B, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for the species (6.6% of 2,000 acres). Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1)and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP. Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, and Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1B would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 1B as a whole on San Joaquin kit fox and American badger would not be significant under CEQA.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project related conservation areas within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Plan Implementation on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger habitat. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facilities, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, and implementation of other measures as described in AMM1–AMM6, AMM10, AMM24, and AMM37 and Mitigation Measure BIO-162.

NEPA Effects: Implementation of the AMMs listed above and Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger,* would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on San Joaquin kit fox or American badger.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 1B construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. In addition, Mitigation Measure BIO-162 would reduce the impact of indirect effects of Alternative 1B on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

This section describes the effects of Alternative 1B, including water conveyance facilities construction and implementation of other conservation components, on San Joaquin pocket mouse. Habitat for this species consists of the grassland natural community throughout the Plan Area. The species requires friable soils for burrowing.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-1B-60. Full implementation of Alternative 1B would also include the following conservation actions over the term of the BDCP that would likely benefit San Joaquin pocket mouse.

- Protect at least 8,000 acres of grasslands (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands to connect fragmented patches of protected grasslands (Objective GNC1.2, associated with CM8).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (Objective GNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-60. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 1B (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	400	400	358	358	NA	NA
Total Impacts CM1		**400**	**400**	**358**	**358**		
CM2–CM18	Grassland	888	2,055	239	274	385–1,277	514
Total Impacts CM2–CM18		**888**	**2,055**	**239**	**274**	**385–1,277**	**514**
TOTAL IMPACTS		**1,288**	**2,455**	**597**	**632**	**385–1,277**	**514**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 1B conservation measures would result in the combined permanent and temporary loss of up to 3,209 acres of habitat for San Joaquin pocket mouse (of which 2,654 acres would be a permanent loss and 555 acres would be a temporary loss of habitat, Table 12-1B-60). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Enhancement (CM2), Tidal Natural Communities Restoration (CM4), Seasonally Inundated Floodplain Restoration (CM5), Grassland Natural Community Restoration (CM8), Vernal Pool Natural Community and Alkali Seasonal Wetland Complex Restoration (CM9), Nontidal Marsh Restoration (CM10), and Conservation Hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 1B conveyance facilities would result in the combined permanent and temporary loss of up to 761 acres of potential San Joaquin pocket mouse habitat (403 acres of permanent loss, 358 acres of temporary loss) in CZ 3–CZ 6, CZ 8, and CZ 9. The majority of grassland that would be removed would be in CZ 8 and CZ 9, from the construction of the new canals. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1B construction locations. Construction of the forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Wildlife 2013).

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement (CM2) would permanently remove 261 acres of potential San Joaquin pocket mouse habitat in the Yolo Bypass in CZ 2. In addition, 165 acres would be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 1,506 acres of potential San Joaquin pocket mouse habitat. The majority of the losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment remaining grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough.
- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain (CM5) would permanently and temporarily remove approximately 481 acres of San Joaquin pocket mouse habitat (449 permanent, 32 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM8 Grassland Natural Community Restoration and CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of *CM8* and *CM9* in CZ 1, CZ 8, and CZ 11. However, all areas would be restored to their original or higher value habitat after the construction periods. The resulting restoration of 2,000 acres of grassland would benefit San Joaquin pocket mouse.
- *CM11 Natural Communities Enhancement and Management:* The protection of 8,000 acres of grassland for covered species is also expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.

  A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. With full implementation of the BDCP, enhancement and management actions designed for western burrowing owl would also be expected to benefit these species. San Joaquin pocket mouse would benefit particularly from protection of grassland habitat against potential loss or degradation that otherwise could occur with future changes in existing land use.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of San Joaquin pocket mouse habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA. Alternative 1B would remove 1,877 acres of San Joaquin pocket mouse habitat (1,354 permanent, 523 temporary) in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 761 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Grassland Natural Community Restoration [CM8], Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], and Conservation Hatcheries [CM18] 1,116 acres).

Typical NEPA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,522 acres of grassland natural communities should be protected to mitigate the CM1 permanent and temporary effects on 751 acres of San Joaquin pocket mouse habitat. The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, especially considering that a large portion of the affected grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,624 acres of potential habitat for San Joaquin pocket mouse. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 3,209 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8 and CZ 11 and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area). All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

***NEPA Effects*:** In the absence of other conservation actions, the loss of San Joaquin pocket mouse habitat associated with Alternative 1B would represent an adverse effect as a result of habitat modification and potential mortality of a special-status species. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM6, and AMM10 which would be in place throughout the construction period, the effects of habitat loss and potential mortality under Alternative 1B on San Joaquin pocket mouse would not be adverse.

***CEQA Conclusion*:** Alternative 1B (CM1–CM5, and CM11) would have both temporary and permanent impacts on San Joaquin pocket mouse and its habitat and operation of construction equipment could disturb individuals, if present in the study area.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would be less than significant under CEQA. Alternative 1B would remove 1,877 acres of modeled (1,354 permanent, 523 temporary) habitat for San Joaquin pocket mouse in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 761 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM8 Grassland*

Natural Community Restoration, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, and *CM18 Conservation Hatcheries*—1,116 acres).

Typical CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,522 acres of grassland natural communities should be protected to mitigate the CM1 losses of 645 acres of San Joaquin pocket mouse habitat.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under CM11 Natural Communities Enhancement and Management, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, especially considering that a large portion of the affected grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1B would be less than significant under CEQA.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,624 acres of potential habitat for San Joaquin pocket mouse. Alternative 1B as a whole would result in the permanent loss of and temporary effects on 3,209 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8 and CZ 11 and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area). All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM6, and AMM10, the loss of habitat or direct mortality through implementation of Alternative 1B would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Impact BIO-165: Indirect Effects of Plan Implementation on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat over the term of the BDCP. These potential effects would be minimized and avoided through AMM1–AMM6 and AMM10, which would be in effect throughout the plan's construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

NEPA Effects: Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on San Joaquin pocket mouse.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6 and AMM10, as part of Alternative 1B construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report* for details on methods and results, and Table 12A-2 in Appendix 12A).

The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat, at the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Construction and restoration associated with Alternative 1B conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-1B-61. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. The conservation measures that would be implemented to achieve the biological goals and objectives that would also benefit special-status bats are summarized below.

- Protect or restore 142,200 acres of high-value natural communities (Objective L1.1, associated with CM3). This objective includes protecting and restoring a variety of habitat types described below (BDCP Chapter 3, Table 3.3-2).
    - Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
    - Protect 600 acres of existing vernal pool complex (Objective VPNC1.1, associated with CM3).
    - Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
    - Protect 8,100 acres of managed wetland (Objective MWNC1.1, associated with CM3 and CM11).
    - Protect 48,625 acres of cultivated lands (Objective CLNC1.1, associated with CM3 and CM11).
    - Protect, restore, or create 2,740 acres of rice land or equivalent habitat type for the giant garter snake (Objective GGS3.1, associated with CM3, CM4, and CM10).
    - Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and 8).

- Restore 67 acres of vernal pool complex (Objective VPNC1.2, associated with CM3 and 9).
- Restore and protect 65,000 acres of tidal natural communities (Objective L1.2, associated with CM2, 3, and 4).
- Restore or create 5,000 acres of valley/foothill riparian natural community (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1B-61. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 1B (acres) [a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Roosting	474	474	322	322	NA	NA
	Foraging	8,572	8,572	13,255	13,255	NA	NA
Total Impacts CM1		**9,046**	**9,046**	**13,577**	**13,577**	**NA**	**NA**
CM2–CM18	Roosting	524	1,570	167	212	324	411
	Foraging	14,497	60,399	773	2,126	21,265	10,137
Total Impacts CM2–CM18		**15,021**	**61,969**	**940**	**2,338**	**21,589**	**10,548**
TOTAL IMPACTS		**24,067**	**71,015**	**14,517**	**15,915**	**21,589**	**10,548**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Affected roosting habitat acreages include valley/foothill riparian habitat, developed lands, and orchards. An unknown number of buildings, bridges, tunnels, and individual trees could also be affected but were not included in this analysis. Foraging habitat includes all natural communities, cultivated lands, and developed lands in the study area. Foraging habitat effects for CM2-CM18 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands).

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as the maximum possible based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 1B conservation measure CM1 would result in the permanent and temporary loss combined of up to 796 acres of roosting habitat and 21,827 acres of foraging habitat for special-status bats in the study area. DWR identified three bridges as potential night roosting that could be affected by construction in CM1. Conservation measures Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5) would result in the permanent and temporary loss of 1,782 acres of roosting habitat and the conversion of approximately 65,525 acres of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Habitat enhancement and management activities (CM11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect special-status bat habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1B conveyance facilities would result in the permanent loss of approximately 474 acres of roosting habitat and 8,572 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 322 acres of roosting habitat and up to 13,255 acres of foraging habitat for special-status bats in the study area (Table 12-1B-61). DWR identified three bridges with potential night roosting habitat for bats; one is in a new bridge construction area, the other two are within the railroad work area that could be affected by construction for CM1.
- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the conversion of approximately 2,025 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM2 would also result in the permanent removal of 89 acres and temporary removal of 167 acres of roosting habitat for special-status bats. The maternity colony of Mexican free-tailed bats located at both ends of the Yolo Causeway bridge could also be affected during construction for CM2. Implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would ensure that improvements in the Yolo Bypass avoid effects on roosting special-status bats.
- C*M4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of approximately 56,810 acres of foraging habitat into wetlands that could still be used by bats for foraging. Approximately 1,425 acres of roosting habitat for special-status bats would permanently affected. This habitat is of low value, consisting of a small, isolated patch surrounded by cultivated lands, and the species has a relatively low likelihood of being present in these areas. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, described below, requires that tidal natural communities restoration avoid effects on roosting special-status bats.
- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the conversion of an estimated 3,690 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM5 would also result in the permanent removal of 57 acres and temporary removal of 45 acres of roosting habitat for special-status bats in the study area.

- *CM11 Natural Communities Enhancement and Management*: Implementation of Alternative 1B would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Implementation of Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7 and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measure described below.
- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to conservation components could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measure.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses of roosting habitat under CM1, CM2, and CM4.

Alternative 1B would permanently or temporarily affect 1,487 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (796 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 565 acres of the 1,487 acres of roosting habitat losses would be in valley/foothill riparian habitat.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 565 acres of riparian habitat should be restored and 565 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1B.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these effects.

The BDCP also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1B as a whole would affect 2,578 acres of roosting habitat (Table 12-1B-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses of roosting habitat under CM1, CM2, CM4, and CM5.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

NEPA Effects: In the near-term the losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 1B are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of roosting and foraging habitat for special-status bats associated with Alternative 1B, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6 and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 1B as a whole on special-status bats would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 1B would permanently or temporarily affect 1,487 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (796 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 565 acres of the 1,487 acres of roosting habitat losses would be in valley/foothill riparian habitat.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 565 acres of riparian habitat should be restored and 565 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1B.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these impacts to a less-than-significant level.

The permanent loss of roosting habitat from Alternative 1B would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The BDCP also contains commitments to implement AMM1–AMM6 and AMM10. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1B as a whole would affect 2,578 acres of roosting habitat (Table 12-1B-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species roost in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential injury or mortality of individuals as a result of implementation of the Alternative 1B activities would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

The permanent loss of roosting habitat resulting from Alternative 1B would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications, and no substantial reduction in numbers or a restriction in the range of special-status bats. Therefore, Alternative 1B would not result in a significant impact on special-status bats under CEQA.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.

- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined by DWR in consultation with CDFW and shall include, as applicable, measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.
- Disturbance of the bridge will be avoided between March 1 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bat species that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal would be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 3[1], later tree removal may be considered in consultation with CDFW.
- Trees would be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent feasible and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction would be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:

- Eviction will not occur before September 15th and will match the timeframe for tree removal approved by CDFW.
- Qualified biologists will carry out or oversee the eviction tasks monitor the tree trimming/removal.
- Eviction will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
- Eviction will take place during weather and temperature conditions conducive to bat activity.
- Special-status bat roosts will not be disturbed.

Eviction procedures shall include but are not limited to:

- Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.
- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Noninjurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat will also be determined through consultation with CDFW and may include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, “bat bark,” planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. “Bat bark” has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Plan Implementation on Special-Status Bats

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat over the term of the BDCP.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural communities restoration would potentially indirectly affect special-status bat species. *CM12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *CM12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from BDCP tidal natural communities restoration.

NEPA Effects: Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 1B would not have an adverse effect on special-status bats.

***CEQA Conclusion*:** Indirect effects from conservation components operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures,* would reduce this impact to a less-than-significant level and ensure Alternative 1B would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 324 acres of roosting habitat and 21,265 acres of foraging habitat for special-status bats in the study area (Table 12-1B-61).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate up to 411 acres of roosting habitat and 10,137 acres of foraging habitat for special-status bats (Table 12-1B-61). Potential roosting trees are likely to be retained within seasonally flooded areas, although high velocity flooding could uproot some trees. Seasonal flooding would not adversely affect foraging habitat for the species. The overall effect of seasonal inundation in existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for special-status bats that use riparian habitats.

***NEPA Effects*:** Periodic effects on roosting and foraging habitat for special-status bats associated with implementing Alternative 1B are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address any effects of periodic inundation on special-status bats and roosting habitat. Therefore, Alternative 1B would not adversely affect the species.

***CEQA Conclusion*:** Periodic inundation under CM2 and floodplain restoration under CM5 would periodically affect foraging and roosting habitat for special-status bats in the study area. Any impact of periodic inundation on special-status bats would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Plant Species

Vernal Pool Plants

Five covered plant species and 12 noncovered special-status plant species occur in vernal pools in the study area (Tables 12-2, 12-3, summarized in Table 12-1B-62). The vernal pool habitat model used for the impact analysis was based on vegetation types and associations from various data sets which were used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which the species are known to occur, including vernal pool complex and degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 1B.

Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit covered vernal pool plants (BDCP Chapter 3, Section 3.3, *Effects on Covered Wildlife and Plant Species*).

- Protect two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Objective VPP1.1, associated with CM3).
- Maintain no net loss of Heckard's peppergrass in Conservation Zones 1, 8, or 11 within restoration sites or within the area of affected tidal range of restoration projects (Objective VPP1.2, associated with CM3 and CM9).

The construction and restoration activities covered under Alternative 1B could have impacts on special-status vernal pool plants. Modeled vernal pool habitat is within the proposed footprint for the Alternative 1B water conveyance facilities and within the hypothetical footprints for restoration activities, although no known occurrences of the 17 covered and noncovered vernal pool plant species is within the proposed footprint for the Alternative 1B water conveyance facilities or the footprint for restoration activities. Table 12-1B-62 summarizes the acreage of modeled vernal pool habitat in the study area, the number of occurrences of each special-status vernal pool plant in the study area, and potential effects.

Table 12-1B-62. Summary of Impacts on Vernal Pool Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Vernal pool complex	9,557	2	0	0	Habitat loss from tidal restoration
Degraded vernal pool complex	2,567	373	0	0	Habitat loss from construction of water conveyance facilities and tidal restoration
Alkali seasonal wetland	188	0	0	0	None
Total	**12,312**	**375**	**0**	**0**	
Covered Species					
Alkali milk-vetch	0	0	16	0	None
Dwarf downingia	0	0	12	0	None
Boggs Lake hedge-hyssop	0	0	1	0	None
Legenere	0	0	8	0	None
Heckard's peppergrass	0	0	4[a]	0	None
Noncovered Species					
Ferris' milk-vetch	0	0	6	0	None
Vernal pool smallscale	0	0	2	0	None
Hogwallow starfish	0	0	0	0	None
Ferris' goldfields	0	0	4	0	None
Contra Costa goldfields	0	0	7	0	None
Cotula-leaf navarretia	0	0	5	0	None
Baker's navarretia	0	0	3	0	None
Colusa grass	0	0	1	0	None
Bearded popcorn-flower	0	0	5	0	None
Delta woolly marbles	0	0	3	0	None
Saline clover	0	0	9	0	None
Solano grass	0	0	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Alternative 1B could affect habitat for special-status vernal pool plants. The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Four acres of modeled habitat would be removed by construction of the water conveyance facilities. However, no known occurrences of the 17 special-status vernal pool plants are within the proposed footprint for the Alternative 1B water conveyance facilities. Because the proposed footprint for the Alternative 1B water conveyance facilities affects very little modeled habitat, effects on undiscovered occurrences of special-status vernal pool plant species are highly unlikely.

- *CM2 Yolo Bypass Fisheries Enhancement*: No modeled vernal pool habitat and no known occurrences of special-status vernal pool plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit covered vernal pool plants by protecting 600 acres of vernal pool complex in CZ 1, CZ 8, and CZ 11 (Objective VPNC1.1). The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species. These benefits also would accrue to any noncovered vernal pool plants occurring in the protected vernal pool complex.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would result in the inundation of 373 acres of vernal pool complex and would, therefore, potentially affect special-status vernal pool plants. However, most of this habitat (373 acres) consists of degraded vernal pool habitat that is unlikely to contain special-status plants. In addition, 257.8 acres of critical habitat for Contra Costa goldfields could be affected. No known occurrences of covered and noncovered vernal pool plants would be affected by tidal restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered vernal pool plants.
- *CM6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM8 Grassland Natural Community Restoration*: Although the vernal pool complex habitat includes grassland matrix within which the vernal pools occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within vernal pool complex habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered vernal pool plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, BDCP activities result in the net loss of vernal pool habitat, CM9 would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plants would be low. However, vernal pool restoration potentially could adversely affect remnant populations of special-status vernal pool plants or potentially affect vernal pool habitat adjacent to the restoration areas.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on covered and noncovered vernal pool plants.

- *Avoidance and Minimization Measures*: Effects on covered vernal pool plants potentially resulting from implementation of CM4 would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM12 Vernal pool Crustaceans*, and *AMM12 Vernal Pool Crustaceans*. AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. AMM12 also requires that that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 would not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM37 requires that new recreation trails avoid populations of covered vernal pool plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In addition, the BDCP includes species-specific goals to benefit covered vernal pool plants. This includes protecting two occurrences of alkali milkvetch (Objective VPP1.1) and requiring no net loss of Heckard's peppergrass (Objective VPP1.2).

In summary, no adverse effects on covered special-status vernal pool plants would be expected from implementing Alternative 1B. No known occurrences of special-status vernal pool plants would be affected. Beneficial effects on special-status vernal pool plants could occur by protecting 600 acres of vernal pool complex in CZ 1, CZ 8, and CZ 11 and by protecting occurrences of alkali milk-vetch.

The GIS analysis estimated that up to_375 acres of vernal pool complex could be adversely affected by covered activities under Alternative 1B. However, the actual effect on habitat for special-status vernal pool plants is expected to be much less than the estimated impact because the BDCP limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants (Objective VPNC1.2, associated with CM9). This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts. The limitation on the loss of wetted vernal pool habitat would constrain the implementation of tidal restoration projects that are adjacent to vernal pool complex, which could affect the feasibility of restoring 65,000 acres of tidal habitat (Objective TPANC1.1, associated with CM4).

NEPA Effects: The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through CM9. Therefore, Alternative 1B would not result in adverse effects on covered and noncovered vernal pool plant species.

CEQA Conclusion: Because loss of modeled habitat for covered vernal pool plants would be offset through restoration, and because impacts on occurrences of covered vernal pool plants would be avoided, the impacts of implementing Alternative 1B on covered and noncovered special-status vernal pool plants in the study area would be less than significant. No mitigation is required.

Alkali Seasonal Wetland Plants

Five covered species and three noncovered plants occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1B-63). Alkali seasonal wetland habitat was modeled separately for four covered plant species occurring in seasonal alkali wetlands.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit covered alkali seasonal wetland plants (BDCP Chapter 3, Section 3.3, *Effects on Covered Wildlife and Plant Species*).

- Of the 150 acres of alkali seasonal wetland complex protected under Objective ASWNC1.1, 600 acres of vernal pool complex protected under Objective VPNC1.1, and 8,000 acres of grassland natural community protected under Objective GNC1.1, protect 75 acres of suitable brittlescale habitat and 75 acres of suitable heartscale habitat in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.1, associated with CM3).
- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.2, associated with CM3).

Alternative 1B would have adverse effects on modeled habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. It would also have adverse effects on occurrences of heartscale, Heckard's peppergrass, and crownscale. Table 12-1B-63 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland plant in the study area.

Table 12-1B-63. Summary of Impacts on Alkali Seasonal Wetland Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	748	0	0	Habitat loss from construction of water conveyance facilities, construction of Yolo Bypass fisheries enhancements, tidal habitat restoration, and floodplain restoration levee construction
Brittlescale modeled habitat	451	4	0	0	Habitat loss from tidal habitat restoration
Heartscale modeled habitat	6,528	306	0	0	Habitat loss from tidal habitat restoration
Delta button celery modeled habitat	3,361[a]	21	0	0	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	72	0	0	Habitat loss from tidal restoration and Yolo Bypass fisheries enhancements
Covered Species					
San Joaquin spearscale	0	0	19	1	Population loss from tidal habitat restoration
Brittlescale	0	0	6	0	None
Heartscale	0	0	3	0	None
Delta button celery	0	0	1[b]	0	None
Heckard's peppergrass	0	0	1[c]	1	Population loss from tidal habitat restoration
Noncovered Species					
Crownscale	0	0	17	1	Population loss from construction of water conveyance facilities
Palmate-bracted bird's-beak	0	0	1	0	None
Recurved larkspur	0	0	4	0	None

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Modeled habitat for Delta button-celery would be adversely affected by construction of the Alternative 1B water conveyance facilities. One population of crownscale also would be adversely affected by construction of the water conveyance facilities. Modeled habitat for brittlescale and heartscale could be adversely affected by tidal habitat restoration. One occurrence each of heartscale and Heckard's peppergrass could be affected by tidal habitat restoration. No adverse effects on palmate-bracted bird's-beak or recurved larkspur would be expected.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Under Alternative 1B, construction of the Byron Tract Forebay would permanently remove 69 acres of modeled habitat for San Joaquin spearscale and 21 acres of modeled habitat for Delta button-celery. This could be an adverse effect, depending on whether the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Known occurrences of San Joaquin spearscale near the forebay do not appear to be affected by facilities construction. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected.

  Construction of the water conveyance facilities would permanently remove 0.2 acre of habitat occupied by crownscale at the Byron Tract Forebay. Part of the occurrence would be removed, but most of the occurrence would not be directly affected. However, a reduction of the population size, both in area and number of individuals present, would be an adverse impact.

  Construction of the water conveyance facilities would not affect brittlescale, heartscale, Heckard's peppergrass, palmate-bracted bird's-beak, or recurved larkspur.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would permanently remove 56 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No modeled habitat and no known occurrences of the seven other alkali seasonal wetland plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.

- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, and/or 11. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration is expected to convert alkali seasonal wetlands on the margins of tidal wetlands to freshwater or brackish tidal marsh. Tidal habitat restoration would convert 622 acres of modeled habitat for San Joaquin spearscale to tidal marsh. Tidal habitat restoration would permanently remove 4 acres of modeled habitat for brittlescale in CZ 1 near Lindsey Slough and in CZ 11 near Nurse Slough; however, the BDCP would allow up to 50 acres of modeled habitat to be converted to tidal wetlands. Tidal habitat restoration would remove 306 acres of modeled habitat for heartscale in CZ 1 in the vicinity of Jepson Prairie and in CZ 11 adjacent to Suisun Marsh. The extent to which the modeled habitat is actually occupied by these species is not known; modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Tidal habitat restoration could adversely affect one occurrence of Heckard's peppergrass at Hass Slough and one occurrence of San Joaquin spearscale at Main Prairie, both in CZ 1. These occurrences are based on historic records, and whether the populations still exist is not known. In each case, the loss of modeled habitat and occurrences for covered species would be adverse effects. Delta button celery, crownscale, palmate-bracted bird's-beak, and recurved larkspur would not be affected by tidal habitat restoration.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the removal of 2 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No other alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM8 Grassland Natural Community Restoration*: Although the alkali seasonal wetland habitat includes the grassland matrix within which the wetlands occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within alkali seasonal wetland habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants. In addition, the BDCP would compensate for the loss of alkali seasonal wetlands from other CMs by restoring or creating 72 acres of alkali seasonal wetlands in Conservation Zones 1, 8, or 11 to achieve no net loss of this habitat.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *Avoidance and Minimization Measures*: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of CM1 and CM4 would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring,* and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of

existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of covered species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM37 requires that new recreation trails avoid populations of covered alkali seasonal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, only one known occurrence of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 1B, although one historic occurrence of Heckard's peppergrass and one historic occurrence of San Joaquin spearscale could also be affected by tidal restoration activities, if those occurrences still exist. AMM11 would be implemented to avoid an adverse effect on Heckard's peppergrass and San Joaquin spearscale occurrences.

The primary effect of the Alternative 1B on special-status alkali seasonal wetland plants would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. Approximately 72 acres of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland plants is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the BDCP limits the total loss of wetted vernal pool habitat to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex (Objective VPNC1.2, associated with CM9). Approximately 72 acres of alkali seasonal wetlands would be restored (Objective ASWC1.2, associated with CM9). Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis (Objective GNC1.1, associated with CM8). These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

The BDCP would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland habitat. The BDCP also includes the species-specific goal that 75 acres would be modeled habitat for brittlescale and heartscale (Objective BRIT/HART/SJSC1.1) and another goal that would protect 2 occurrences of San Joaquin spearscale (Objective BRIT/HART/SJSC1.1). The benefits of habitat protection and management also would accrue to any noncovered alkali seasonal wetland plants occurring in the protected habitat.

NEPA Effects: Under Alternative 1B, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (CM8, CM9), and impacts on one occurrence of San Joaquin spearscale and one occurrence of Heckard's peppergrass would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse. The loss of one occurrence of crownscale, a noncovered species, would result in a reduction in the range and numbers of this species and would be an adverse effect. Adverse effects on crownscale could be avoided or offset through implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*.

CEQA Conclusion: Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of covered alkali seasonal wetland plants would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 1B would not result in substantially reducing the number or restricting the range of five covered and two noncovered plant species. However, conservation measures that benefit or protect covered species do not apply to noncovered species, and portions of the crownscale population at Byron Tract Forebay would be lost, which would be a significant impact. Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plants, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppy and caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for the special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered plants if practicable. The purpose of these surveys will be to verify that the locations of special-status plants identified in previous record searches or surveys are extant, identify any new special-status plant occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plants will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of covered fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having noncovered special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasible through the establishment of 250-foot activity exclusion zones surrounding the periphery of occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be established according to a 250-foot buffer surrounding the periphery of each special-status species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be

required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.

- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Grassland Plants

One covered plant and 11 noncovered special-status plants occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-1B-64). The only covered plant species occurring in grassland is Carquinez goldenbush. Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extend of alluvium deposits in close proximity to the actual rivers/streams.

Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit covered grassland plants (BDCP Chapter 3, Section 3.3, *Effects on Covered Wildlife and Plant Species*).

- Protect three unprotected occurrences of the Carquinez goldenbush in Conservation Zones 1 and/or 11 (Objective CGB1.1, associated with CM3).
- Maintain and enhance occupied Carquinez goldenbush habitat to slow erosion and reverse degradation from livestock grazing (Objective CGB1.2, associated with CM11).

Of 78,047 acres of grasslands in the study area, Alternative 1B would adversely affect 3,037 acres, including 4 acres that are modeled habitat for Carquinez goldenbush. For 10 of the plants, no known occurrences would be affected. One of five Parry's rough tarplant occurrences in the study area could be adversely affected by Alternative 1B. Table 12-1B-64 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland plant in the study area.

Table 12-1B-64. Summary of Impacts on Grassland Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,019	4	0	0	Habitat loss from tidal habitat restoration
Grassland	78,047	3,037	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, floodplain restoration, and construction of conservation hatcheries
Covered Species					
Carquinez goldenbush	0	0	10	1	Habitat loss from tidal habitat restoration
Noncovered Species					
Big tarplant	0	0	5	0	None
Round-leaved filaree	0	0	2	0	None
Pappose tarplant	0	0	7	0	None
Parry's rough tarplant	0	0	5	1	Periodic inundation of one occurrence as a result of Yolo Bypass operations
Small-flowered morning-glory	0	0	0	0	None
Diamond-petaled poppy	0	0	1	0	None
Stinkbells	0	0	1	0	None
Fragrant fritillary	0	0	4	0	None
Gairdner's yampah	0	0	0	0	None
Streamside daisy[a]	0	0	1	0	None
Caper-fruited tropidocarpum	0	0	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified in the BDCP.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plant Species

Alternative 1B, could have adverse effects on modeled habitat for Carquinez goldenbush. It could also have adverse effects on one occurrence of Carquinez goldenbush and one occurrence of Parry's rough tarplant. Although Alternative 1B would have no expected effects on known occurrences of the other special-status plant species that occur in grasslands, the loss of 3,037 acres of grassland would have the potential to adversely affected undocumented populations of special-status grassland species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland plants are within the proposed footprint for the Alternative 1B water conveyance facilities. About 758 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat primarily consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 1B, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland plants.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 627 acres of grassland habitat. Yolo Bypass operations would result in more frequent and longer inundation of 1,597 acres of grasslands in the Yolo Causeway (CZ 2) that include habitat for one occurrence of Parry's rough tarplant. Parry's rough tarplant is a summer-blooming plant that occurs in areas subject to occasional inundation during the wet season, such as swales and seasonal wetlands. Increasing the frequency or duration of inundation may decrease the distribution in some areas by making some conditions too wet but would also expand the distribution into areas that may currently be too dry. Overall, changing the frequency and duration of inundation in the area of this occurrence should not result in a substantial change in the range of numbers of Parry's rough tarplant. Construction and operation of the Yolo Bypass fisheries enhancements would not affect modeled habitat for Carquinez goldenbush or known occurrences of other special-status grassland plants.
- *CM3 Natural Communities Protection and Restoration*: Alternative 1B would preserve 8,000 acres of grassland habitat, some of which may contain modeled habitat for Carquinez goldenbush. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 1,122 acres of grassland habitat. Four acres of modeled habitat for Carquinez goldenbush along the eastern side of Suisun Marsh could be adversely affected, including part of one known occurrence. No other known occurrences of special-status grassland plants are within the hypothetical footprint of tidal restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of new floodplain levees would result in the loss of 85 acres of grassland habitat, periodic inundation of the floodplain would affect 513 acres of grassland habitat, and another 399 acres of grassland habitat would be converted to riparian habitat. However, no modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for floodplain restoration, and the affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered grassland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status

grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered grassland plants.

- *CM7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered grassland plants.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would restore 2,000 acres of grassland habitat. Restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands. These areas do not currently provide habitat for special-status grassland plants. Therefore, grassland communities restoration would have no impacts on covered and noncovered grassland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plants would not be present. Therefore, vernal pool and Alkali Seasonal Wetland complex restoration would not affect special-status grassland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on covered and noncovered grassland plants.
- *CM18 Conservation Hatcheries*: Construction of the conservation hatcheries would remove 35 acres of grassland habitat. The removed habitat would consist of ruderal herbaceous vegetation that would not be likely to provide habitat for special-status grassland plants. Therefore, construction of the conservation hatcheries would not be expected to affect special-status grassland plants.
- *Avoidance and Minimization Measures*: Effects on Carquinez goldenbush potentially resulting from implementation of CM4 and potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. AMM37 requires that new recreation trails would avoid populations of Carquinez goldenbush. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The primary effect of Alternative 1B on special-status grassland plants is the loss of potential (i.e., modeled) habitat for Carquinez goldenbush, including part of one known occurrence. Under AMM11, the occurrence would be surveyed to establish the population limits and to redesign the project to avoid affecting the populations, to the extent feasible. Protecting three unprotected occurrences of Carquinez goldenbush (Objective CGB1.1, associated with CM3) and maintaining and enhancing occupied Carquinez goldenbush (Objective CGB1.2, associated with CM11) would compensate for any residual effects. One occurrence of Parry's rough tarplant would be affected by CM2, but the effect is not expected to be adverse. No known occurrences of the other special-status grassland plants would be affected.

The BDCP would have a potential beneficial effect on special-status grassland plants by protecting 8,000 acres of grassland habitat. To ensure that this habitat preservation would specifically benefit Carquinez goldenbush, the plan proposes to protect at least three Carquinez goldenbush occurrences in CZ 1 and CZ 11 that are currently not protected and to maintain and enhance occupied Carquinez goldenbush habitat. The preservation of modeled or potential habitat, together with avoidance and minimization of impacts on species occurrences, would reduce any effects of BDCP implementation on covered grassland plants to a level that is no longer adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for Carquinez goldenbush would be offset through CM3, CM8, and CM11. Therefore, implementation of Alternative 1B would result in no adverse effects on special-status grassland plants.

***CEQA Conclusion*:** Because adverse effects on special-status grassland plant species would be avoided or compensated for, Alternative 1B would not result in a reduction in the range and numbers of covered and noncovered grassland plants, and this impact would be less than significant. No mitigation is required.

Valley/Foothill Riparian Plants

Two covered plants and two noncovered special-status plants occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-1B-65). The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit covered valley/foothill riparian plants (BDCP Chapter 3, Section 3.3, *Effects on Covered Wildlife and Plant Species*).

- Protect and enhance two occurrences of delta button celery. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of delta button celery for a total of two occurrences within the restored floodplain habitat on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. (Objective DBC1.1, associated with CM3 and CM11).
- Protect and enhance two occurrences of slough thistle. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of slough thistle for a total of two occurrences within the 10,000 acres of restored floodplain on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis (Objective ST1.1: associated with CM3 and CM11).

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 1B would adversely affect 896 acres, including 15 acres that are modeled habitat for Delta button-celery and 11 acres that are modeled habitat for slough thistle. Table 12-1B-65 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status grassland plant in the study area.

Table 12-1B-65. Summary of Impacts on Valley/Foothill Riparian Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button celery modeled habitat	3,361[a]	15	0	0	Habitat loss from floodplain restoration
Slough thistle modeled habitat	1,834	11	0	0	Habitat loss from floodplain restoration
Valley/foothill riparian habitat	17,966	896	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta button celery	0	0	1[b]	1	Occurrence potentially affected by floodplain restoration
Slough thistle	0	0	2	2	Occurrences potentially affected by floodplain restoration
Noncovered Species					
Northern California black walnut	0	0	1	0	None
Wright's trichocoronis	0	0	1	0	None

[a] portion of this acreage consists of alkali seasonal wetland.
[b] A second occurrence is in alkali seasonal wetland.

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plants are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would be affected by restoration of seasonally inundated floodplain.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the water conveyance facilities would remove 91 acres of valley-foothill riparian habitat under Alternative 1B. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the proposed footprint for the Alternative 1B water conveyance facilities. Therefore, under Alternative 1B, construction and operation of the water conveyance facilities would not affect covered or noncovered special-status valley/foothill riparian plants.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction and operation of the Yolo Bypass fisheries enhancements would adversely affect 378 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass fisheries enhancements would not affect the covered or noncovered valley/foothill riparian plants.
- *CM3 Natural Communities Protection and Restoration*: Alternative 1B would protect 552 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 552 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for tidal restoration. Therefore, tidal restoration would not affect the covered or noncovered valley/foothill riparian plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 15 acres of modeled habitat for Delta button-celery along the San Joaquin River in CZ 7. In addition, floodplain restoration would result in more frequent and longer inundation of 18 acres of modeled habitat for Delta button-celery in this area. The area affected contains one historic occurrence of Delta button celery. This occurrence is considered to be extirpated, because all habitat for Delta button-celery at his location has been converted to agriculture (California Department of Fish and Wildlife 2013). Therefore, Alternative 1B would not have an adverse effect on Delta button celery in CZ 7.

  The BDCP proposes to benefit Delta button-celery at this location by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of Delta button-celery. Although Delta button celery occurs in riparian habitat, it is not associated with woodland or scrub habitats; rather, it occurs in alkali seasonal wetlands in floodplains, which may or may not also contain adjacent woody riparian habitat. Restoring habitat for Delta button-celery may not be compatible with restoring woody riparian habitat. In addition, establishing new populations of Delta button-celery is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on Delta button-celery would be speculative.

  Floodplain restoration levee construction would remove 11 acres of modeled habitat for slough thistle and would result in more frequent and longer inundation of 6 acres of modeled habitat for slough thistle along the San Joaquin River in CZ 7. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to riparian habitat. Whether the affected modeled habitat is actually occupied by slough thistle is not known; however, of two historic occurrences of slough thistle present in the study area, only one is considered to be extirpated (California Department of Fish and Wildlife 2013). The BDCP would protect and enhance two occurrences of slough thistle. If occurrences are not found in the study area, then two self-sustaining occurrences of slough thistle would be established using locally-sourced genetic material for a total of two occurrences within the restored floodplain habitat on the main stem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. Establishing new populations of slough thistle is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on slough thistle would be speculative.

One historic occurrence of Wright's trichocoronis in the study area near Lathrop (CZ 7) could also be affected by floodplain restoration. The occurrence is presumed to be extant because the presence or absence of suitable habitat has not been verified by field surveys (California Department of Fish and Wildlife 2013). However, the species has not been observed at this location for nearly a century, and habitat for Wright's trichocoronis, which would have been similar to that for Delta button celery and slough thistle, no longer appears to be present in aerial photographs of the area. Therefore, Alternative 1B would not be expected to have an adverse effect on Wright's trichocoronis.

- *CM6 Channel Margin Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM8 Grassland Natural Community Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool and alkali seasonal wetland complex restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM22 Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of CM5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 1B is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for covered plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 1B would not have an adverse effect on these species.

The BDCP proposes to benefit Delta button-celery and slough thistle by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of both species. Establishing new populations of Delta-button-celery or slough thistle would be a beneficial effect. However, establishing new populations is an untried, unproven procedure and may not be feasible.

NEPA Effects: Implementing the BDCP under Alternative 1B would not have an adverse effect on special-status valley/foothill riparian plant species.

CEQA Conclusion: Alternative 1B would not result in a reduction in the range and numbers of covered and noncovered valley/foothill riparian plants, and this impact would be less than significant. No mitigation is required.

Tidal Wetland Plants

Seven covered plants and one noncovered special-status plant occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1B-66). Five tidal wetland habitat models were developed for the seven covered plant species occurring in tidal wetland habitat.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitats cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 1B would include the following conservation actions over the term of the BDCP to benefit covered tidal wetland plants (BDCP Chapter 3, Section 3.3, *Effects on Covered Wildlife and Plant Species*).

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites, or within the area of affected tidal range of restoration projects (Objective DMW/ML1.1, associated with CM4 and CM11).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Objective DTP/SMA1.1, associated with CM4 and CM11).
- Restore tidal inundation to wetlands in the Hill Slough Ecological Reserve and to the ponded area at Rush Ranch (Objective SBB/SuT1.1, associated with CM4).
- Complete seed banking of all existing Suisun Marsh populations and the representative genetic diversity using accepted seed banking protocols (Objective SBB/SuT1.2, associated with CM11).
- Establish a cultivated population of Suisun thistle from wild seed using accepted seed collection protocols (Objective SBB/SuT1.3, associated with CM11).
- Establish two occurrences of Suisun thistle in Conservation Zone 11 (Objective SBB/SuT1.4, associated with CM11).

Of 17,357 acres of tidal wetlands in the study area, Alternative 1B would affect 28 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, Suisun Marsh aster, soft bird's-beak, and Suisun thistle. Known occurrences of all of these species would be affected. In addition, four occurrences of Bolander's water-hemlock, a noncovered special-status plant, could be affected by tidal habitat restoration. Table 12-1B-66 summarizes the acreage of modeled habitat for covered tidal wetland species and the number of occurrences of each special-status tidal wetland plants in the study area.

Table 12-1B-66. Summary of Impacts on Tidal Wetland Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/Mason's lilaeopsis modeled habitat	6,081	53	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Side-flowering skullcap modeled habitat	2,447	13	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Soft bird's-beak modeled habitat	1,228	73	0	0	Habitat loss from tidal habitat restoration

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Delta tule pea/Suisun Marsh aster modeled habitat	5,853	5	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Suisun thistle modeled habitat	1,281	73	0	0	Habitat loss from tidal habitat restoration
Tidal brackish emergent wetland	8,501	0	0	0	Habitat loss from tidal habitat restoration
Tidal freshwater emergent wetland	8,856	28	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta mudwort	0	0	58	3	Occurrences affected by tidal habitat restoration
Delta tule pea	0	0	106	28	Occurrences affected by tidal habitat restoration
Mason's lilaeopsis	0	0	181	18	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Side-flowering skullcap	0	0	12	2	Occurrences affected by construction of water conveyance facilities
Soft bird's-beak	0	0	13	7	Occurrences affected by tidal habitat restoration
Suisun Marsh aster	0	0	164	27	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Suisun thistle	0	0	4	0	None
Noncovered Species					
Bolander's water hemlock	0	0	8	3	Occurrences affected by tidal habitat restoration

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 1B would have adverse effects on tidal marsh special-status plants through implementation of CM1, CM2, CM4, and CM5. No adverse effects are expected from implementation of CM3, CM6, CM7, CM8, and CM9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would remove 39 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 7 acres of modeled habitat for side-flowering skullcap, and 4 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, three occurrences of Mason's lilaeopsis, two occurrences of Delta tule pea, and two occurrences of side-flowering skullcap in the study area could be affected by construction impacts. No known occurrences of the other covered and noncovered tidal wetland species would be affected by construction of the water conveyance facilities.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 5 acres of modeled habitat for Mason's lilaeopsis and delta mudwort. The extent to which modeled habitat is actually occupied by these species is not known; however, no known occurrences in the study area would be affected. Yolo Bypass operations would result in more frequent and longer inundation of 8 acres of modeled habitat Delta tule peas and Suisun Marsh aster. Two occurrences of Suisun Marsh aster would be affected by Yolo Bypass operations. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes restoring or creating 20 linear miles of transitional tidal areas within other natural communities that would be created or restored, including 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland. In addition, the habitat and ecosystem functions of these areas would be maintained and enhanced. The BDCP does not specifically propose to protect any occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences. Instead, the BDCP assumes that the 20 linear miles of restored transitional tidal areas will be passively colonized by the covered tidal wetland plants.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 6 acres of modeled habitat for Mason's lilaeopsis and Delta mudwort. Habitat loss would occur through conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 14 of 181 known occurrences of Mason's lilaeopsis and 3 of 58 known occurrences of delta mudwort in the study area could be affected by tidal habitat restoration.

  Tidal habitat restoration would remove 4 acres of modeled habitat for side-flowering skullcap. Whether the affected modeled habitat is actually occupied by side-flowering skullcap is not known; however, none of the 12 known occurrences in the study area would be affected.

  Tidal habitat restoration would remove 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. However, the BDCP would allow up to 50 acres of modeled habitat to be removed. Habitat loss would result from conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 26 of 106 known occurrences of Delta tule pea and 24 of 164 occurrences of Suisun Marsh aster in the study area would be affected.

Tidal habitat restoration could affect 73 acres of modeled habitat for soft bird's-beak and Suisun thistle, including 1.3 acres of critical habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, seven of 13 known occurrences of soft bird's-beak in the study area could be affected. None of the four known occurrences of Suisun thistle in the study area would be affected.

Tidal habitat restoration could affect three of eight known occurrences of Bolander's water-hemlock, a noncovered special-status species in the study area. Because Bolander's water-hemlock occurs in tidal marsh, it may benefit from tidal marsh restoration. However, site preparation, earthwork, and other site activities could adversely affect Bolander's water-hemlock through direct habitat removal.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 3 acres of modeled habitat for Mason's lilaeopsis and delta mudwort and 2 acres of modeled habitat for side-flowering skullcap. No known occurrences of these species in the study area would be affected by floodplain restoration.

  Floodplain restoration would result in more frequent and longer inundation of 2 acres of modeled habitat for Mason's lilaeopsis and delta mudwort, 18 acres of modeled habitat for side-flowering skullcap, and 1 acre of modeled habitat for Delta tule peas and Suisun Marsh aster. No known occurrences of these species in the study area would be affected by periodic inundation of restored floodplain habitat. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed separately from the effects of tidal habitat restoration. Channel margin enhancement would have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would have beneficial effects on these species by improving the habitat functions for these species as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.

- *CM7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of CM4 and CM5. Riparian plantings carried out for CM7 would be placed in floodplain areas, not in tidal wetlands.

- *CM8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool and alkali seasonal wetland complex restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on covered and noncovered tidal wetland plants.

- *Avoidance and Minimization Measures*: Effects on covered tidal wetland plants potentially resulting from implementation of CM1, CM2, CM4, and CM5 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 contains specific guidance to avoid adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. AMM30, which specifies that proposed transmission line poles and towers would be sited to avoid sensitive terrestrial and aquatic habitats, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis, Delta tule pea, and side-flowering skullcap. AMM37 requires that new recreation trails avoid populations of covered tidal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, the GIS analysis indicates that Alternative 1B would result in the loss of modeled habitat for all of the covered species and result in adverse effects on known occurrences of most of the special-status plants occurring in tidal wetlands. However, the BDCP predicts that habitat restoration activities would greatly expand the amount of habitat available to each of these species, offsetting any potential loss of habitat or occurrences resulting from covered activities.

Delta mudwort could lose 53 acres of modeled habitat (0.9%), including all or part of three occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta mudwort, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Mason's lilaeopsis could lose 53 acres of modeled habitat (0.9%), including all or part of 18 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Mason's lilaeopsis; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Delta tule pea could lose 5 acres of modeled habitat (0.08%), including all or part of 28 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by

Delta tule pea, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) would also consider the potential for creating habitat for Delta tule pea; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

Suisun Marsh aster could lose 5 acres of modeled habitat (0.08%), including all or part of 27 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun Marsh aster, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Suisun marsh aster; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would occur and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

All four of these species (Delta mudwort, Mason's lilaeopsis, Delta tule pea, and Suisun Marsh aster) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring large areas of habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected (less than 1% of the total), it is likely that the initial adverse effects of covered activities on these species would be offset and that the overall effect of Alternative 1B on these species would not be adverse.

Side-flowering skullcap could lose 13 acres of modeled habitat (0.5%), including all or part of two occurrences. One occurrence would be avoided through implementation of AMM30. The location of a second potentially affected occurrence, which was last observed in 1892, is not known precisely. Under AMM11, this occurrence would be surveyed for, and because this is a tidal freshwater wetland species, avoidance of the habitat during project construction would be highly likely. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by side-flowering skullcap, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for side-flowering skullcap; creation of suitable habitat under these measures could also help offset this habitat loss. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, and because loss of modeled habitat for the species would be offset through restoration, the overall effect of Alternative 1B on this species would not be adverse.

Soft bird's-beak could lose 73 acres of modeled habitat (6%), including all or part of seven occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by soft bird's-beak, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve would be done to increase potential habitat there for soft bird's-beak (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for soft bird's-beak. Although no active restoration of this species is proposed, post-implementation monitoring of soft bird's-beak occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Soft bird's-beak has a restricted distribution in the study area with highly localized occurrences, and habitat modification is the primary factor responsible for the species' decline and limiting the species' distribution and abundance. Improving habitat functions for this species would provide a reasonable expectation that the distribution and abundance of soft bird's-beak would also improve. Although a substantial amount of modeled habitat could be affected, the primary habitat for soft bird's-beak is high tidal brackish marsh, and the affected habitat is low tidal brackish marsh. Therefore, it is likely that the overall effect of Alternative 1B on this species would not be adverse.

Suisun thistle could lose 73 acres of modeled habitat (6%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun thistle, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve and at Rush Ranch would be done to increase potential habitat there for Suisun thistle (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for Suisun thistle. In addition, two new occurrences of Suisun thistle would be established in CZ 11 (Objective SBB/SuT1.4, associated with CM11). Post-implementation monitoring of Suisun thistle occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Habitat restoration, enhancement of habitat functions, and establishment of new occurrences would offset any potential loss of modeled habitat for Suisun Marsh thistle.

Three occurrences of Bolander's water-hemlock could be affected. Although the extent of potential habitat affected was not determined, it would be comparable to that for Delta tule pea and Suisun Marsh aster (5 acres). Tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) could increase the extent of habitat available for colonization by Bolander's water-hemlock, which could offset this habitat loss. Because only a few scattered occurrences of Bolander's water-hemlock are present in the study area, there is no reasonable expectation that habitat restoration without active species-specific restoration activities would result in the establishment of new occurrences to offset the losses. Also, because Bolander's water-hemlock is a noncovered species, the species protections and occurrence monitoring afforded to covered species under the BDCP would not apply to this species. Therefore, the effects of Alternative 1B on Bolander's water hemlock could be adverse.

NEPA Effects: The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (CM4). Therefore, implementation of Alternative 1B would result in no adverse effects on seven of eight special-status grassland plants in the study area. Alternative 1B would result in a reduction in the range and numbers of Bolander's water-hemlock, which would be an adverse effect. Adverse effects on Bolander's water-hemlock could be avoided or offset through implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*.

***CEQA Conclusion*:** Because loss of occurrences and modeled habitat for covered tidal habitat plant species would be offset through habitat restoration, impacts on covered tidal wetland plants as a result of implementing Alternative 1B would not be significant. However, the loss of Bolander's water-hemlock populations in CZ 11 would result in a reduction in the range and numbers of this species and would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

Inland Dune Plants

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 1B would have no adverse effects on inland dune plants (Table 12-1B-67). No construction activities or habitat restoration would take place where the species occur. No specific actions to benefit inland dune species are proposed.

Table 12-1B-67. Summary of Impacts on Inland Dune Plants under Alternative 1B

	Acres in Study Area	Acres affected	Occurrence in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Inland Dunes	19	0	0	0	None
Noncovered Species					
Hoover's cryptantha	0	0	1	0	None
Antioch Dunes buckwheat	0	0	1	0	None
Mt. Diablo buckwheat	0	0	1	0	None
Contra Costa wallflower	0	0	3	0	None
Antioch Dunes evening-primrose	0	0	9	0	None

***NEPA Effects*:** Implementing the BDCP under Alternative 1B would not affect special-status inland dune plant species.

***CEQA Conclusion*:** Implementation of Alternative 1B would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Plants

No covered plant species occur in nontidal wetlands in the study area; however, six noncovered special-status plant species occur in nontidal wetlands in the study area. Table 12-1B-68 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland plant in the study area.

Table 12-1B-68. Summary of Impacts on Nontidal Wetland Plants under Alternative 1B

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	293	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Nontidal freshwater perennial emergent wetland	1,509	137	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Noncovered Species					
Watershield	0	0	3	0	None
Bristly sedge	0	0	18	4	Loss of habitat from construction of water conveyance facilities
Woolly rose-mallow[a]	0	0	121	15	Loss of habitat from construction of water conveyance facilities and from tidal habitat restoration
Eel grass pondweed	0	0	1	0	None
Sanford's arrowhead	0	0	23	3	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Marsh skullcap[a]	0	0	3	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 1B, known occurrences of bristly sedge and woolly rose-mallow are within the proposed footprint for the water conveyance facilities or within the hypothetical footprint for restoration activities and would be adversely affected. Alternative 1B would have no adverse effects on watershield, eel-grass pondweed or marsh skullcap.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would adversely affect three noncovered special-status plants occurring in nontidal wetlands. Two occurrences of bristly sedge in CZ 4 and CZ 5, including approximately 1.54 acres of occupied habitat, would be affected by construction of the water conveyance facilities. Eleven occurrences of woolly rose-mallow would be affected. Five occurrence would be affected by construction of the intake structures, and six occurrences would be affected by siphon works areas and borrow/spoils sites. Two occurrences of Sanford's arrowhead would be affected.
- *CM2 Yolo Bypass Fisheries Enhancement*: No known occurrences of special-status nontidal wetland plants are present in the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect special-status nontidal marsh plants.
- *CM3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under the BDCP. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *CM4 Tidal Natural Communities Restoration*: One known occurrence of Sanford's arrowhead in CZ 2 and one occurrence of woolly rose-mallow in CZ 7 are present within areas proposed for tidal habitat restoration and could be lost as a result of habitat conversion. Therefore, tidal habitat restoration would have an adverse effect on these species. No other special-status tidal wetland plants would be affected.
- *CM5 Seasonally Inundated Floodplain Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on special-status nontidal wetland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status nontidal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status nontidal wetland plants.
- *CM8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool and alkali seasonal wetland complex restoration would have no impacts on special-status nontidal wetland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing

nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. The BDCP may benefit nontidal wetland species by creating 400 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for covered and other native species. However, no specific actions to benefit noncovered species are proposed.

Under Alternative 1B, 1,500 acres of nontidal marsh would be restored (Objective NFEW/NPANC1.1, addressed under CM10). However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to bristly sedge, woolly rose-mallow, and Sanford's arrowhead, potential loss of habitat or occurrences resulting from covered activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under the BDCP, the species protections afforded to covered species under the AMMs do not apply to these species, and the effects of Alternative 1B on these species would be adverse.

***NEPA Effects*:** Implementation of the BDCP under Alternative 1B could result in a reduction in the range and numbers of bristly sedge, woolly rose-mallow, and Sanford's arrowhead, three noncovered nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

***CEQA Conclusion*:** Under Alternative 1B, construction of the water conveyance facilities and tidal habitat restoration could result in a reduction in the range and numbers of bristly sedge, woolly rose-mallow, and Sanford's arrowhead. Tidal habitat restoration could result in a reduction in the range and numbers of Sanford's arrowhead and woolly rose-mallow. These impacts would be significant. Implementation of Mitigation Measure BIO-170 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

General Terrestrial Biology Effects

Wetlands and Other Waters of the United States

Alternative 1B actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by the USACE under Section 404 of the CWA. The Section 404 regulations and relevant information on mitigating impacts on wetlands and waters of the United States are described in Section 12.2.1.1. The following two impacts address the project-level effects of CM1 on these potential wetlands and waters, and the programmatic-level effects of other relevant conservation actions (CM2–CM10). CM11–CM21 would not directly result in loss or conversion of wetlands or other waters of the United States. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. The waters of the United States data used for this analysis is based on a verified wetland delineation from USACE that was completed in early 2015. These waters of the United States were mapped at finer scale than that which was done for the natural community mapping for the BDCP and therefor the acreages of these two datasets differ. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States

Alternative 1B proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-1B-69. Based on the methodology used to conduct this analysis, the losses would occur at pipeline, canal and intake areas, borrow/spoil storage sites, transmission corridors, forebay site, and multiple temporary work areas associated with the construction activity. The permanent open water and wetland losses would occur at scattered locations along the water conveyance facility alignment, with the majority caused by construction of Alternative 1B's five intake structures along the eastern bank of the Sacramento River between Freeport and Courtland in the north Delta (including associated spoil/borrow areas), along the entire canal route in the east Delta, and at the Byron forebay site in the south Delta. The temporary open water and wetland effects would also occur mainly at the five intake construction sites along the eastern bank of the Sacramento River, and at temporary siphon work areas where the canal crosses under eastern Delta sloughs and waterways.

Table 12-1B-69. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 1B (acres)

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact	Total Impact
Agricultural Ditch	228.0	31.1	0	259.1
Alkaline Wetland	0.1	0	0	0.1
Clifton Court Forebay	1.0	0	0	1.0
Conveyance Channel	12.7	1.1	0	13.8
Depression	35.1	1.9	0	37.0
Emergent Wetland	77.6	20.0	0	97.6
Forest	9.3	6.9	0	16.2
Lake	0.2	0.3	0	0.5
Scrub-Shrub	13.8	12.2	0	26.0
Seasonal Wetland	177.5	0	0	177.5
Tidal Channel	28.1	146.3	0	174.3
Vernal Pool	0	0	0	0
Total	**583**	**220**	**0**	**803**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

The majority of the impacts on wetlands and waters of U.S. are to wetlands found within cultivated lands (mostly agricultural ditches and seasonal wetlands), tidal channel, and emergent wetlands. These impacts mostly result from reuseable tunnel material areas, canal construction, and siphon work areas. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the Clean Water Act permitting process. The results of this assessment will be compared to the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands would be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Because many impacted wetlands are significantly less than high function, the compensatory mitigation would result in a net increase in wetland function.

Alternative 1B was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures would be implemented, as described in the AMMs set out in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, and in Appendix 11F, *Substantive BDCP Revisions*, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the United States are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, would also result in further avoidance and minimization of effects on waters of the United States.

Aside from wetland habitats that would be created as a result of implementing CM4–CM10, some of which could serve the dual purpose of offsetting effects on species and mitigating impacts on waters of the United States, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 1B pursuant to USACE's and U.S. EPA's Mitigation Rule (see Section 12.2.1.1). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to address adverse impacts on waters of the United States.

NEPA Effects: The permanent and temporary loss of these jurisdictional wetlands and waters as a result of constructing Alternative 1B water conveyance facilities would be a substantial effect if not compensated by wetland protection and/or restoration. This loss would represent a removal of federally protected wetlands as defined by Section 404 of the CWA. Project proponents under Alternative 1B would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects on wetlands and waters. Specific mitigation would be required to ensure that Alternative 1B does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

***CEQA Conclusion*:** The permanent and temporary loss of these jurisdictional wetlands and waters of the United States as a result of constructing Alternative 1B water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 1B does not result in a loss of functions and values of waters of the U.S. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be available to reduce the impact to a less-than-significant level. Alternative 1B does propose to restore up to 76,721 acres of wetland natural communities under the Plan, which would include 65,000 acres of tidal marsh restoration (CM4), 10,000 acres of seasonally inundated floodplain restoration (CM5), 21 acres of vernal pool/alkali seasonal wetlands (CM9; 67 acres of vernal pool complex and 72 acres of alkali seasonal wetland complex assuming a wetland density of 15%), and 1,700 acres of nontidal marsh restoration (CM10). In addition, Alternative 1B would restore 5,000 acres of riparian habitat (CM7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 20 miles of levees will have channel margin enhancement conducted on them (CM6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees. Impacts on wetlands from CM1 construction would occur in the first 10 years after BDCP approval. Approximately 20,065 acres of this wetland restoration would occur during this time period

The success in implementing these Conservation Measures would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP Chapter 3, *Conservation Strategy*, for tidal marsh restoration (BDCP Section 3.4.4), seasonal floodplain restoration (BDCP Section 3.4.5.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 1B would also result in the protection and management of the following natural communities that contain wetlands: 750 acres of valley/foothill riparian, 600 acres of vernal pool complex, 150 acres of alkali seasonal wetland complex, 8,100 acres of managed wetlands, and 50 acres of nontidal marsh. In addition, 8,000 acres of grasslands and 51,625 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

The project proponents under Alternative 1B would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of waters of the United States and any indirect effects on wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 1B does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the U.S.

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 1B's other conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and waters of the United States in the study area over the course of BDCP conservation action implementation. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures (CM2, CM4 and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in Chapter 5, *Effects Analysis*, of the BDCP.

Because the wetland delineation was only conducted within the Conveyance Planning Area and not the remainder of the Plan Area, the effects on potential wetlands and waters of the United States from CM2-CM10 were analyzed by looking at effects on wetland natural communities mapped within the theoretical footprints for CM2, CM4, and CM5 by assuming that 100% of the predominantly wetland natural communities listed in Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species,* and that 10% of all of the non-wetland natural communities listed in that table would qualify as wetlands or other waters of the United States under the CWA. Based on this approach approximately 19,850 acres of potentially jurisdictional wetlands and waters could be affected by CM2-CM10. The majority of these impacts are attributable to the conversion of 13,746 acres of managed wetland to tidal marsh under CM4, which would likely result in an improvement of wetland function in the Plan Area.

NEPA Effects: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1B would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. Although the increase in wetland acreage and wetland functions from these restoration actions could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

CEQA Conclusion: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1B would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. In total, up to 76,721 acres of wetland natural communities would be restored under Alternative 1B. Although the increase in wetland acreage and wetland functions from these restoration could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds. The primary effects of concern for shorebirds and waterfowl are related to the conversion of managed wetland and cultivated lands to tidal marsh associated with habitat restoration. Ducks Unlimited (2013) conducted an analysis to determine the effects of BDCP conservation measures on waterfowl, as well as to determine whether BDCP actions would impede attainment of the goals established by the Central Valley Joint Venture (CVJV) Implementation Plan for the Delta, Yolo, and Suisun Marsh drainage basins. The CVJV efforts are guided by its 2006 Implementation Plan, which is founded on the principles of strategic habitat conservation (Central Valley Joint Venture 2006). Those principles emphasize the establishment of population abundance objectives and the use of species-habitat models to link population objectives to habitat needs. The CVJV has used species-habitat models to translate bird abundance objectives into habitat objectives, while explicitly identifying the biological assumptions that underpin these models and the data used to populate them. As a result, the CVJV's biological planning provides a framework for evaluating the effects of the BDCP on waterfowl.

The Ducks Unlimited waterfowl analysis focused primarily on dabbling ducks. Less than 5% of all geese in the Central Valley occur in the Yolo, Delta, and Suisun Marsh drainage basins. Moreover, geese in the Central Valley rely mostly on agricultural habitats to meet their food energy needs. The BDCP's effect on agricultural habitats is limited to the Delta Basin where about 2500 acres of corn now available to geese would be converted to other habitats (Ducks Unlimited 2013: Table 5). Food supplies for geese would still be well in excess of demand even with the loss of these agricultural habitats (Central Valley Joint Venture 2006, Ducks Unlimited 2013). The duck population objectives used in the analysis were taken directly from the CVJV Plan. Dabbling duck species make up 92% of this objective, while diving duck species make up the remaining 8%. Thus, the results were mostly driven by dabbling duck needs and largely interpreted in the context of dabbling duck foraging ecology. The 55,000 acres of Tidal Natural Communities Restoration (CM4) would be expected to benefit diving ducks by providing deep water foraging habitat. Refer to the Ducks Unlimited Report (Ducks Unlimited 2013) for details of the analysis and methods with respect to the TRUMET model used to quantify effects on food biomass and food quality.

An analysis was conducted to determine the effects of the BDCP covered activities on wintering and breeding shorebird habitat (ICF International 2013). This analysis evaluated the relative increase and decrease in natural communities known to provide important foraging, roosting, and breeding habitat. Similar to the waterfowl analysis, the results were broken up into the three Central Valley Joint Venture Basins that overlap with the BDCP study area: Yolo, Delta, and Suisun. Natural community losses and gains were then translated into species-specific outcomes, comparing the relative habitat value of each BDCP natural community for each Central Valley shorebird species (Table 1, ICF International 2013). The shorebird species ranking system displayed in Table 1 (ICF International 2013) was modified from a table in Stralberg et. al (2010). The table was created using survey data and experts' species-specific habitat rankings. The survey data included fall, winter, and spring density data. This resulted in an overall, cross-season representation of habitat requirements.

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities (CM1) would result in the permanent removal of approximately 6 acres of managed wetland, 8 acres of tidal wetlands, 24 acres of nontidal wetlands, and 4,091 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 18 acres of managed wetland, 11 acres of tidal wetlands, 11 acres of nontidal wetlands and 7,470 acres of suitable cultivated lands would be temporarily impacted. These losses of habitat would occur within the first 10 years of Alternative 1B implementation in the Delta Basin. The BDCP has committed to the near-term protection of 15,400 acres of non-rice cultivated lands, 200 acres of rice, and 700 acres of rice or "rice equivalent" natural communities including nontidal wetlands in the near-term. In addition, 4,100 acres of managed wetlands would be created, protected, and enhanced, 8,850 acres of freshwater tidal wetlands would be restored, and 2,000 acres of tidal brackish emergent wetland would be restored (Table 3-4, Chapter 3).

Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

NEPA Effects**:** Habitat loss from construction of the Alternative 1B water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction or nests or disturbance of nesting and foraging behaviors, which would be an adverse effect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

CEQA Conclusion**:** Habitat loss from construction of the Alternative 1B water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Conservation Components

Suisun Marsh: Managed seasonal wetlands in Suisun Marsh would be reduced by an estimated 8,818 acres as a result of Alternative 1B. This would represent a 25% decrease in managed seasonal wetlands compared with long-term conditions without Alternative 1B (Ducks Unlimited 2013, Table 5). There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in the Suisun's managed wetlands, which makes it difficult to identify the amount of mitigation needed. To address this uncertainty, three levels of food biomass and three levels of nutritional quality were modeled for these existing habitats (Ducks Unlimited 2013, Table 7). Three mitigation scenarios were based on these energetic assumptions of biomass and food quality were then run to determine a minimum acreage of managed seasonal wetlands to be protected and enhanced to compensate for the loss of productivity from habitat conversion to tidal wetlands.

- Scenario 1) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Under this assumption, the managed seasonal wetlands in Suisun produce 50% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 60% of the metabolizable energy of seeds produced outside of Suisun. Given the assumption that managed seasonal wetlands in Suisun could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 5,000 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 2) Assume that the managed seasonal wetlands lost provide medium food biomass and medium food quality. Under this assumption, the managed seasonal wetlands in Suisun produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun. Given the assumption that managed seasonal wetlands in Suisun could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 13,300 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 3) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Given the assumption that managed seasonal wetlands in Suisun could only be enhanced to provide medium food biomass and medium food quality (produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun), 8,800 acres of managed wetlands protected and managed for medium biomass and medium food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

The BDCP has committed to protecting and enhancing a minimum of 5,000 acres of managed seasonal wetlands in Suisun to compensate for the loss of productivity from habitat conversion to tidal marsh. This minimum commitment of 5000 acres would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation

Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

Yolo and Delta Basins: The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta Watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo Watershed would not be expected to have an adverse effect on food productivity, under the assumption that these wetlands would provide adequate food sources. However, a monitoring component and a food study in these tidal habitats would be necessary order to demonstrate that there is a less-than-significant loss of food value in these habitats for wintering waterfowl. If it is determined from monitoring, that there is in fact a significant loss in food productivity from habitat conversion to tidal wetlands, the protection and enhancement of managed wetlands in these watersheds would be required to mitigate the change in food biomass and quality. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty.

NEPA Effects**:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of effect that Alternative 1B habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1B to avoid an adverse effect on wintering waterfowl in the Suisun Marsh. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta Watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these wetlands would provide adequate food sources is entirely dependent on assumptions about food production in palustrine tidal habitats. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty and avoid an adverse effect on wintering waterfowl.

CEQA Conclusion**:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of impact that Alternative 1B habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that

1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food for wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1B to avoid having a significant impact on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Implementation of Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would address this potential significant impact.

The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta Watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo Watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these tidal wetlands would provide adequate food sources is are entirely dependent on assumptions about food production in palustrine tidal habitats. Studies of food biomass and food quality in palustrine tidal habitats are needed to confirm that no mitigation for wintering waterfowl is required in the Yolo and Delta Basins. Implementation of Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would address this uncertainty and would reduce this impact on wintering waterfowl to a less-than-significant level.

Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh

Poorly managed wetlands (considered low biomass and food quality) will be identified and managed by BDCP proponents to improve food quality and biomass. Studies will be required to quantify 1) food production of existing managed wetlands in Suisun Marsh and 2) energetic productivity of brackish and tidal marsh habitats. Protected wetlands will be monitored to measure changes in the energetic productivity of these sites. Based on the food studies and monitoring results, BDCP proponents will determine if the minimum commitment of 5,000 acres is sufficient to meet the goal of 1:1 compensation for loss of wintering waterfowl habitat with the protection and management of managed wetlands in perpetuity. If monitoring demonstrates that additional acreage is needed to meet this goal, additional acreage of protection or creation of managed wetlands and management will be required.

Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins

In order to address the uncertainty of the impact of loss of managed wetlands in the Yolo and Delta Basins on wintering waterfowl, BDCP proponents will conduct food studies and monitoring to demonstrate the food quality of palustrine tidal habitats in these basins. If studies show that the assumption of no effect was inaccurate, and the food quality goal of 1:1 compensation for wintering waterfowl food value is not met, additional acreage of protection or creation of managed wetland and management will be required.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Conservation Components

Yolo and Delta Basins: Alternative 1B would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1B would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. While a reduction in these semipermanent habitats would represent a habitat loss for breeding waterfowl, with the restoration of 24,000 acres of palustrine tidal wetlands (Table 3-4, Chapter 3) in the Yolo and Delta basins there would be a less than adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (i.e., March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1B.

Suisun Marsh: Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres from the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared to seasonally managed habitats (Central Valley Joint Venture 2006).

The BDCP includes a commitment to protect and enhance 1,600 acres of permanently flooded managed wetlands in Suisun Marsh to provide habitat for breeding waterfowl. In addition, 5,000 acres of semipermanent wetlands that would be protected and enhanced for wintering and migratory waterfowl (Table 3-4, Chapter 3; Objective MWNC1.1 in BDCP Chapter 3, *Conservation Strategy*).

Food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. These studies would be needed in order to quantify impacts on breeding waterfowl in Suisun Marsh and to determine not only the number of acres that would compensate for loss of breeding habitat at a ratio of 1:1 for habitat value, but how those acres should be managed. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of this effect.

In addition to providing semipermanent wetlands to breeding waterfowl, the Suisun Marsh contains several key upland areas that have significant nesting value. The largest block of upland habitat in the region is the core area on the Grizzly Island Wildlife Area. This area does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this core area includes over 2,000 acres of upland grasslands that have some of the highest duck nesting densities in California (Central Valley Joint Venture 2006). A few small wetland areas are scattered within this core grassland mosaic that provide necessary freshwater brooding habitat. If restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding waterfowl would likely be greatly increased.

NEPA Effects: Alternative 1B would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1B would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1B would not have an adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1B. Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but such management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss of breeding waterfowl habitat resulting from implementation of Alternative 1B could have an adverse effect. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of model assumptions and the potential adverse effect of habitat conversion on breeding waterfowl in Suisun Marsh.

CEQA Conclusion: Alternative 1B would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1B would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1B would have a less-than-significant impact on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1B.

Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss or conversion of habitat from implementation of Alternative 1B could have a significant impact on breeding waterfowl in Suisun Marsh. Implementation of Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would address the uncertainty of model assumptions and reduce the impact to a less-than-significant level.

Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

To address the uncertainty of the impact of loss of managed wetlands in Suisun Marsh on breeding waterfowl, BDCP proponents will conduct food studies and monitoring to determine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the marsh.

The required studies will examine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the Marsh. Reproductive studies will address but will not be limited to the following questions:

- How does the distribution of breeding waterfowl in Suisun Marsh differ in tidal versus managed habitats and across salinity gradients?
- How does waterfowl nest success and nest density vary with respect to tidal versus managed habitats and across salinity gradients?
- What are the patterns of habitat selection and movements by waterfowl broods in relation to tidal vs. managed habitats, and are there impacts on duckling survival?
- What is the current relationship between waterfowl reproductive success and interactions with alternate prey and predators, and how is tidal restoration likely to alter these relationships?

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from the Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20 cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

Yolo Basin: Primarily as a result of *CM4 Tidal Natural Communities Restoration* within the Yolo Basin, 1,185 acres of managed wetland habitat would be permanently converted; 1,066 acres of which are protected. In addition, 42 acres of managed wetland habitat would be temporarily lost by construction-related activities associated with tidal restoration (CM4) and fisheries enhancement activities (CM2) (Table 2, ICF International 2013). Increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could periodically affect managed wetlands ranging from an estimated 643 acres during a notch flow of 1,000 cfs to an estimated 2,055 acres during a notch flow of 4,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*) in the Yolo Basin.

Delta Basin: Within the Delta Basin, 90 acres of managed wetland habitat would be permanently converted, as a result of tidal restoration (CM4). Thirteen of the 90 acres are protected (Table 3, ICF International 2013). Periodic flooding would not affect this natural community type in Delta Basin.

Suisun Basin: Within the Suisun Basin, 11,532 acres of managed wetland habitat would be permanently converted as a result of tidal restoration (CM4); 10,354 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (Charadrius semipalmatus), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

Managed wetlands would decrease in overall extent by 20% (Table 5, ICF International International 2013). Most of this loss would occur in Suisun with some additional acreage loss in the Yolo Basin. The loss of managed wetland habitat for covered species and waterfowl would be compensated for with 8,200 acres remaining managed wetland protection in Suisun Marsh. Of these 8,200 acres, the 5,000 acres of seasonal wetland protected, enhanced, and managed to provide overwintering waterfowl foraging habitat would be the habitat type most likely to benefit overwintering shorebirds. However, the 1,600 acres of semi-permanent and permanent managed wetlands for breeding waterfowl and 1,500 acres of managed wetlands for salt marsh harvest mouse would also be expected to have some benefit to wintering and breeding shorebirds.

Cultivated Lands

Yolo Basin: Primarily as a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 8,309 acres of cultivated lands would be permanently converted; 1,272 acres of which are protected. Also within the Yolo Basin, increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could affect an estimated 3,219 acres of cultivated lands during a notch flow of 1,000 cfs to an estimated 5,512 acres during a notch flow of 6,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*).

Delta Basin: Within the Delta Basin, as a result of tidal restoration (CM4) and floodplain restoration (CM5), 25,633 acres of cultivated lands would be permanently converted. There would also be an additional 112 acres lost temporarily due to CM5 activities. Of the total permanently converted lands, 3,925 acres are protected (Table 3, ICF International 2013). Seasonal flooding (CM5) on the restored floodplain would periodically affect 738 acres of cultivated lands in Delta.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Cultivated land loss would occur in all three basins, but the majority of acreage loss would occur in the Delta basin. Pasture crop types would decrease in overall extent by 15% over baseline (Table 5, ICF International 2013), but would increase in protection by 135%. More than half of all cultivated lands within the 48,000-acre BDCP cultivated lands reserve would be in pasture production (primarily alfalfa) and enhanced and managed to benefit Swainson's hawk. Idle crop types are not identified as a specific conservation target in the BDCP, are expected to occur within the reserve and are recognized in the BDCP as having "moderate" foraging habitat value for Swainson's hawk, white-tailed kite, and greater sandhill crane.

Grain and hay crop would be expected to decrease by 13% (Table 5, ICF International 2013) while protection, enhancement and management would be expected to increase by 28% (Table 6, ICF International 2013). These crop types would be managed for a tricolored blackbirds, Swainson's hawk, white-tailed kite, greater sandhill crane, and burrowing owls.

Rice would decrease in overall extent by 2% (Table 5, ICF International 2013) but increase in total protection by 57%. Rice lands would be protected, enhanced, and managed for the benefit for giant garter snake.

Tidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 194 acres of tidal wetland habitat would be permanently converted; 180 acres of which are protected. In addition, 12 acres of tidal wetland habitat would be temporarily lost by construction-related activities associated with fisheries enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass would affect 3,957 acres of tidal wetlands in Yolo Basin.

Delta Basin: Within the Delta Basin, 54 acres of tidal wetlands would be permanently converted as a result of tidal restoration (CM4) (Table 3, ICF International 2013). Of the total permanently converted lands, 26 acres are protected. Periodic flooding in Yolo Bypass would affect 26 acres of tidal wetlands in Delta Basin.

Suisun Basin: Within the Suisun Basin, 219 acres of tidal wetland habitat would be permanently converted as a result of tidal restoration (CM4); 215 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

Tidal mudflat habitat would be estimated to increase in extent by 1,780 acres. This extremely large increase in tidal mudflat habitat would occur almost exclusively in Suisun Marsh as the result of tidal restoration and the conversion of existing mid- and high-marsh types to low marsh and tidal mudflats in response to sea level rise. BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, details the methods and assumptions modeled to come about this result. Tidal mudflat habitats would be expected to require management, however, sediment augmentation has been discussed as an experimental method that could be employed in places like Suisun to combat the loss of intertidal marshes in the face of sea level rise and reduced sediment supplies.

Tidal emergent wetland habitat would increase in extent by 152% (Table 5, ICF International 2013). Of the 30,000 acres of emergent wetland restoration, 6,000 acres would be in the Suisun Basin and the rest would be distributed between the Yolo and Delta Basins. Enhancement and management on these lands would be likely to be focused on nonnative, invasive species management. Any additional actions in Suisun would be focused on salt marsh harvest mouse, Suisun shrew, California clapper rail, black rail, Suisun thistle, and soft bird's-beak. In freshwater marshes, enhancement and management would be likely to focus on black rail, western pond turtle, and, in some cases, giant garter snake.

Nontidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 313 acres of nontidal wetland habitat would be permanently converted; 119 acres of which are protected. In addition, 11 acres of nontidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass associated with ongoing Fremont Weir operation (CM2) would affect 305 acres of nontidal wetlands in Yolo Basin, specifically nontidal perennial aquatic habitat.

Delta Basin: Within the Delta Basin, 99 acres of nontidal wetlands would be permanently converted as a result of tidal restoration (CM4) and floodplain restoration (CM5) (Table 3, ICF International 2013). There would also be 8 acres of nontidal perennial aquatic habitat temporarily lost from CM5 activities. Of the total permanently converted lands, 29 acres are protected. Periodic flooding from CM5 would affect 4 acres of nontidal perennial aquatic habitat in Delta Basin.

Suisun Basin: Within the Suisun Basin, 1 acre of nontidal wetland habitat, specifically vernal pool complex, would be permanently converted as a result of tidal restoration (CM4); and is not protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

Nontidal freshwater emergent wetland would increase in extent by 88% as a result of BDCP implementation (Table 5, ICF International 2013). These lands would be managed to benefit giant garter snake and located within the Delta Basin (likely in the vicinity of White Slough) and the Yolo Basin (in the Cache Slough area).

Impacts on wetted acres of vernal pool complex and alkali seasonal wetland complex would be avoided and thus loss of this community is not expected. However, up to 10 acres of wetted acre loss could be permitted under the Plan. Protection of vernal pool complex natural community would increase by 13% and by 6% for alkali seasonal wetlands (Table 6, ICF International 2013). Protection of these two community types would enhance and manage habitat for vernal pool crustaceans and alkali-related plant species.

The protection and restoration of natural communities would also include management and enhancement actions under *CM11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under CM11, in areas where they would not conflict with covered species management.

- Managed wetlands:
  - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
  - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
  - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
  - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
  - Create low slopes on islands and levees; gradual angles (10-12:1) are better than steep angles.
  - Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
  - Potentially add material to levees or to islands to encourage nesting for some species.
- Cultivated Lands:
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July- September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
  - Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded

for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).

- Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
- Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
- When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
- Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
- Maintain gently sloping levees and island sides (10-12:1; Iglecia et al. 2012).
- Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

NEPA Effects: Alternative 1B implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be substantial loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While substantial losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for the loss of substantial acreage, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

CEQA Conclusion: Alternative 1B implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be significant loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While significant losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for substantial acreage loss, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other conservation actions. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight diverters on new transmission lines, and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect shorebirds and waterfowl, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on shorebirds and waterfowl.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 1B implementation would not have an adverse effect on shorebirds and waterfowl. Tidal habitat restoration is unlikely to have an adverse effect on shorebirds and waterfowl through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds, and the potential for increased exposure would vary substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management*, would address the uncertainty of methylmercury levels in restored tidal marsh. Once site-specific sampling and other information is developed, the site-specific planning phase of marsh restoration would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury.

CEQA Conclusion: Noise, potential hazardous spills, and increased dust and sedimentation as a result of water conveyance facilities construction and operation and maintenance would have a significant impact on shorebirds and waterfowl. AMM1–AMM7 would minimize these impacts, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the impacts to a less-than-significant level. Tidal habitat restoration is unlikely to have a significant impact on shorebirds and waterfowl species through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds. Site-specific restoration plans that address the creation and mobilization of mercury, as well as the monitoring and adaptive management described in CM12, would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury in the study area. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1B implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not covered under laws or regulations that address conservation or protection of individual species. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in the analysis of Alternative 1B effects on natural communities (Impacts BIO-1 through BIO-31). In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the Plan over a 50-year time period, several natural communities and land cover types would be reduced in size, primarily from restoration of other natural communities. Grassland, managed wetland and cultivated land would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement and management actions contained in the BDCP, including *CM3 Natural Communities Protection and Restoration*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing BDCP conservation measures would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife, including increased traffic on local roads from construction vehicles that could increase wildlife mortality and impede wildlife movement. Effects of construction traffic on wildlife moving in the vicinity of Stone Lakes NWR would be minimized by AMM20 *Greater Sandhill Crane* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). AMM20 includes a measure for the installation of a vegetation screen or other noise and visual barrier along Hood Franklin Road for the benefit of cranes that would be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and would provide a continuous surface impenetrable by light. This measure would potentially direct wildlife wishing to cross Hood Franklin Road toward the overcrossing of the canal that links the Stone Lakes properties (just east of the Town of Hood). The overcrossing includes strips of terrestrial habitat on either side of the canal.

Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants or noxious weeds).

***NEPA Effects*:** The direct and indirect effects associated with constructing water conveyance facilities and restoring tidal and other habitats as part of implementing Alternative 1B would not be adverse because the conservation measures and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

***CEQA Conclusion*:** Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of the BDCP is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

ECAs are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effect of BDCP Conservation Measures on Wildlife Corridors

Alternative 1B water conveyance facilities would cross one of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA. The conveyance facilities would also cross four landscape linkages identified in the BDCP, the *San Joaquin River* linkage (#5 in Figure 12-2), the *Middle River* linkage (#6 in Figure 12-2), the *Cosumnes to Stone Lakes* linkage (#10 in Figure 12-2), and the *White Slough to Stone Lakes* linkage (#11 in Figure 12-2). Though the conveyance facilities shown on Figure 12-2 overlap with the line representing the *Sacramento River* linkage (#9 in Figure 12-2) this line generally represents the course of the Sacramento River and is intended to address the needs of aquatic species and will thus not be addressed in this chapter.

The construction of Intakes 1 2, 3, and 4, associated borrow and spoil areas, and the canal from east of Clarksburg to just north of Walnut Grove would occur within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the

Sacramento River and the permanent and temporary loss of grasslands and agricultural lands. These loses would not substantially increase impediments to movement of wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento Deep Water Shipping Channel already create a barrier to dispersal for nonavian species and the loss of the narrow strips of riparian vegetation and agricultural lands would generally not impede the movement of bird species between these areas. However, the construction of the canal and the intakes would create a substantial barrier to the north-south movement of nonavian terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River. There are records of Swainson's hawk, western pond turtle, and American badger that would be affected by construction of the canal (California Department of Fish and Wildlife 2013). Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The addition of new permanent transmission lines within the Stone Lake-Yolo Bypass ECA could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes.

The canal and a borrow and spoils area that occur adjacent to the *Cosumnes to Stone Lakes* linkage, which is identified in the BDCP for reserve planning to benefit greater sandhill crane movement from north to south in the Plan Area, could be in conflict with future reserve planning in this area (see impact discussions for greater and lesser sandhill cranes).

The portion of the canal and associated borrow and spoils area that cross the *White Slough to Stone Lakes* linkage, which is identified in the BDCP for reserve planning to connect the White Slough population of giant garter snake to habitat in the Stone Lakes area, would conflict with BDCP's reserve design planning as well limiting connectivity under Existing Conditions by creating a substantial barrier to movement across this landscape.

Alternative 1B would also cross the *Middle River* and *San Joaquin River* linkages. These linkages were established to guide riparian restoration and protection along the Middle River and San Joaquin River to improve riparian connectivity for the benefit of riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite. Though the canal siphons below both of these river crossings, the adjacent canal, borrow and spoils areas, RTM storage areas, and permanent transmission line would remove existing riparian vegetation at these locations and conflict with the BDCP's plans for establishing habitat connectivity along these river corridors through restoration and preservation.

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the Plan Area.

NEPA Effects: Despite the contributions from restoration and protection activities, Alternative 1B would create substantial barriers to the movement of terrestrial wildlife from the eastern portion of the study area into the central Delta, to the north-south movement of wildlife between the

Sacramento River and I-5, and create barriers to safe movement of avian species during periods of low visibility. The Alternative 1B conveyance facilities would result in adverse effects on wildlife corridors.

CEQA Conclusion: Alternative 1B water conveyance facilities would create a substantial barrier to the north-south movement of terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River within the Stone Lakes-Yolo Bypass ECA.

The addition of new permanent transmission lines within the Stone Lake-Yolo Bypass ECA could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes.

The canal, associated borrow and spoils areas, RTM storage areas, and permanent transmission lines would conflict with the BDCP's reserve design planning for greater sandhill crane, giant garter snake, and covered riparian species.

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

Despite the contributions from restoration and protection activities, Alternative 1B would create a substantial barrier to the movement of terrestrial wildlife from the eastern portion of the Plan Area into the central Delta, to the north-south movement of wildlife between the Sacramento River and I-5, and create barriers to safe movement of avian species during periods of low visibility. The Alternative 1B conveyance facilities would result in significant unavoidable impacts on wildlife corridors. There is no practicable mitigation measure to reduce this impact to a less-than-significant level.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4, *Invasive and Noxious Plant Species*. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry, but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities covered under the BDCP could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of Alternative 1B are:

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.

- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from:

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-1B-70 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 1B of the BDCP.

Table 12-1B-70. Summary of Temporary Disturbance in Natural Communities under Alternative 1B

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	160
Tidal brackish emergent wetland	1
Tidal freshwater emergent wetland	12
Valley foothill riparian	162
Grassland	632
Inland dune scrub	0
Alkali seasonal wetland complex	0
Vernal pool complex	0
Other natural seasonal wetland	0
Nontidal freshwater perennial emergent wetland	8
Nontidal perennial aquatic	32
Managed wetlands	62
Cultivated lands	14,109
Total	**15,178**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Under Alternative 1B, the BDCP would have adverse effects on natural communities from the introduction and spread of invasive plant species through implementation of CM1–CM10 and AMM6. No adverse effects are expected from implementation of CM11–CM21.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1B water conveyance facilities would result in the temporary disturbance of 13,133 acres that would provide opportunities for colonization by invasive plant species.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would result in the temporary disturbance of 758 acres that would provide opportunities for colonization by invasive plant species. Vegetation maintenance activities for the Fremont Weir and Yolo Bypass improvements may include the removal of giant reed; however, the clearing of linear areas to facilitate water flow may also result increased opportunities for invasion. Sediment removal, transportation, and application as a source material for restoration or levee projects as part of Fremont Weir and Yolo Bypass maintenance activities could also result in the spread of invasives if the sediment contains viable invasive plant propagules.
- *CM3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in the eleven CZs would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *CM4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the BDCP Implementation Office would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the BDCP Implementation Office would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the temporary disturbance of 1,285 acres along channels in the north, east, and south Delta (San Joaquin, Old, and Middle Rivers) that would provide opportunities for colonization by invasive plant species.
- *CM6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.

- *CM7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *CM8 Grassland Natural Community Restoration*: The restoration of grassland habitat in CZ 1, CZ 8 and/or CZ 11 would result in the temporary disturbance of degraded grassland or cultivated land that would provide opportunities for colonization by invasive plant species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes in CZ 1, CZ 8, or CZ 11 would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of agricultural lands in CZ 2 and CZ 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.
- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoil, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of CM11, AMM4, AMM10, and AMM11.

CM11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the BDCP reserve system to reduce competition on native species, thereby improving conditions for covered species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbits foot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10 and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would include the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would include methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the BDCP Implementation Office would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the other CMs, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any BDCP restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the Plan Area. Cleaning stations would be established at the perimeter of BDCP covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

***NEPA Effects*:** The implementation of AMM4, AMM10, AMM11, and CM11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

***CEQA Conclusion*:** Under Alternative 1B, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing Alternative 1B would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Conservation Measures with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities (CM1) and implementing CM2–CM21 for Alternative 1B have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 1B would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 1B on terrestrial biological resources are addressed in the discussions of impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the BDCP.

Federal and State Legislation

- The federal *Clean Water Act*, *Endangered Species Act*, *Fish and Wildlife Coordination Act*, *Migratory Bird Treaty Act*, *Rivers and Harbors Act* and *Marine Mammal Protection Act* all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decision making. The biological goals and objectives contained in the BDCP that provide the major guidance for implementing the various conservation elements of Alternative 1B are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the Plan Area. While some of the conservation measures of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term guidance in the Plan would provide for the long-term viability and expansion of the habitats and special-status species populations in the Plan Area. Alternative 1B conservation actions would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.

- The *California Endangered Species Act*, *California Native Plant Protection Act*, *Porter-Cologne Water Quality Control Act*, and *Natural Communities Conservation Planning Act* are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. The BDCP, which is the basis for Alternative 1B, contains biological goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 1B conservation actions would be compatible with the policies and directives contained in these laws.

- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are BDCP proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The BDCP biological goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).

- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the value and diversity of the Marsh's aquatic and wildlife habitats. The BDCP and its plans for protection and restoration of tidal marsh habitats in Suisun Marsh would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The BDCP is intended to become a component of the Delta Plan. The Delta Stewardship Council will determine whether the BDCP is compatible with the goals and objectives of the Delta Plan prior to its incorporation into the Plan. The compatibility of the BDCP with the Delta Plan is considered in detail in Section 13.2.2.2 of Chapter 13, *Land Use*.
- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, value and permanence of wetlands acreages and values in California. The BDCP conservation measures that provide for a significant expansion of wetland acreage and value in the Delta and Suisun Marsh are compatible with the intent of the California Wetlands Conservation Policy.
- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The BDCP Plan Area includes all or portions of three Implementation Plan basins— the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

  Implementation of the Alternative 1B conservation measures would result in significant reductions in cultivated land and managed wetland acreage in the Delta, Yolo and Suisun basins; however, significant increases in tidal and nontidal wetlands in these basins would be another result. Because of the large conversion of managed wetland in the Suisun basin, the BDCP has included a large managed wetland conservation and enhancement goal for this area. For the Suisun basin conversions to be compatible with the 2006 Implementation Plan goals, this EIR/EIS has added mitigation that would require food production studies and adaptive management to ensure that the Suisun basin would continue to provide the waterfowl and shorebird habitat envisioned in the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, *Yolo Bypass Wildlife Area Land Management Plan*, *Grizzly Island Wildlife Area Management Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 1B, especially construction of CM1 and CM2 facilities, and land modification associated with CM4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the BDCP would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Yolo Bypass, on Sherman Island, and in Suisun Marsh would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. The SMPA was signed in 1987 and modified in 2005 by DWR, CDFW, Reclamation and the Suisun Resource Conservation District to establish the mitigation approach in the Marsh for effects of operating the SWP and CVP. The primary concerns were the effects of CVP and SWP Delta diversions on salinity in the Marsh. The SMPA focused on ways to ensure adequate water quality and quantity for the managed wetlands and wildlife habitats in the Marsh to assure equal waterfowl values in the Marsh. The Suisun Marsh Plan, for which a Final EIS/EIR was released in 2010 by these agencies, provides for restoration of tidal marsh habitat and enhancement of managed wetland in the Marsh, maintenance of waterfowl hunting and recreational opportunities in the Marsh, maintenance and improvement of the Marsh levee system, and protection and enhancement of water quality for beneficial uses of the Marsh. An integral component of the Suisun Marsh Plan is balancing continued managed wetland operation with new tidal wetland restoration to provide improved and greater habitat for fish and wildlife species. The Suisun Marsh Plan is a programmatic, long-term plan and does not include specific projects, project proponents, or funding mechanisms. However, the Suisun Marsh Plan relies on tidal restoration to allow for managed wetland operations to continue. The BDCP would provide a funding mechanism and increased management potential relative to existing and restored habitats, assisting the Suisun Marsh Plan in meeting its broader ecological goals, consistent with long-term operation of the SWP and CVP water conveyance facilities. The conservation actions contained in the BDCP, which are designed to ensure the long-term protection and recovery of special-status fish and wildlife species dependent on the Marsh, would be compatible with the water quality and habitat restoration goals of the SMPA and Suisun Marsh Plan.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the Plan's long-term control and management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that Plan objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of BDCP's conservation actions would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 1B would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans and Natural Community Conservation Plans* are the subject of a detailed analysis at the end of this chapter. The analysis considers the compatibility of the BDCP with all HCPs and NCCPs that share planning area with the BDCP Plan Area.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The BDCP proposes to protect, enhance and expand the wetlands of the Plan Area, and, therefore, would be compatible with Executive Order 11990.
- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 1B construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of mitigation measures described in this chapter would be capable of making Alternative 1B implementation compatible with Executive Order 13112.
- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 1B conservation measures that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion conservation measures of Alternative 1B would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

***CEQA Conclusion*:** The potential plan and policy incompatibilities of implementing Alternative 1B identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of large acreages of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the Shorebirds and Waterfowl analysis above and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2.3 of Chapter 13, *Land Use*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations and the relationship between plan and policy consistency and physical consequences to the environment.

12.3.3.4 Alternative 1C—Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario A)

Section 3.5.4 in Chapter 3, *Description of Alternatives*, provides details of Alternative 1C, and Figure 3-6 depicts the alternative.

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal or modification of this community (see Table 12-1C-1). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the tidal perennial aquatic natural community (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

There is a variety of other, less specific conservation goals and objectives in the BDCP that would improve the value of tidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to AMMs, impacts on tidal aquatic natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Note that two time periods are represented in Table 12-1C-1 and the other tables contained in the analysis of Alternative 1C. The near-term (NT) acreage effects listed in the table would occur over the first 10 years of Alternative 1C implementation. The late long-term (LLT) effects contained in these tables represent the cumulative effects of all activities over the entire 50-year term of the Plan. This table and all impact tables in the chapter include reference to only those CMs that would eliminate natural community acreage either through construction or restoration activities, or would result in periodic inundation of the community. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the implementation schedule for all natural community protection and restoration conservation measures.

Table 12-1C-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	25	25	117	117	0	0
CM2	8	8	11	11	9–36	0
CM4	51	58	0	0	0	0
CM5	0	2	0	5	0	39
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**84**	**93**	**128**	**133**	**9–36**	**39**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently affect an estimated 93 acres and temporarily remove 133 acres of tidal perennial aquatic natural community in the study area. These modifications represent less than 1% of the 86,263 acres of the community that is mapped in the study area. The majority of the permanent and temporary effects would happen during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 8,300 acres of tidal wetlands, including an estimated 3,400 acres of tidal perennial aquatic natural community during the same period, which would expand the area of that habitat and offset the losses. The 3,400-acre increase is estimated, based on modeling reported in BDCP Appendix 3.B, Table 5, by comparing existing Plan Area subtidal habitat to near-term subtidal habitat with the Plan. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.1.2) indicates that, while there would be no minimum restoration requirement for the tidal perennial aquatic natural community, an estimated approximately 27,000 acres of tidal perennial aquatic natural community would be restored based on tidal restoration modeling. This estimate is based on Table 5 in BDCP Appendix 3.B, subtracting late long-term without project acreage from late long-term with project acreage.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently remove 25 acres and temporarily remove 117 acres of tidal perennial aquatic community. Most of the permanent loss would be where Intakes W1–5 encroach on the Sacramento River's west bank from just north of Clarksburg to just north of Courtland (see Terrestrial Biology Mapbook, a support document to the EIS/EIR, for a detailed view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. A small area of this community would also be lost to canal construction just east of Elk Slough, across the river from Hood. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, including in the Sacramento River at Intakes W1–5, and at temporary siphon, barge unloading and tunnel work areas along the western tunnel and canal alignment. Elk Slough would be temporarily affected by a tunnel work area south of Clarksburg, and a large siphon work area where the canal would cross under the slough on the west side of Merritt Island. Temporary siphon work areas would affect tidal perennial aquatic habitats on Miner Slough at the north end of Ryer Island, on Rock Slough at its head with Contra Costa Canal, and on Italian Slough immediately adjacent to the west side of Clifton Court Forebay. Barge unloading facilities would create temporary effects on the Sacramento River just upstream of its junction with Cache Slough, and on Fishermans Cut just west of Franks Tract. A control structure work area would temporarily affect the California Aqueduct just south of Clifton Court Forebay. The details of these locations can be seen in the Terrestrial Biology Mapbook. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Tule Canal/Toe Drain and Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 8 acres could be permanently lost and another 11 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would affect 18 acres of tidal perennial aquatic community. CM4 involves conversion of existing natural communities to a variety of tidal wetlands, including tidal perennial aquatic, tidal brackish emergent, and tidal freshwater emergent wetlands. Specific locations for these conversions are not known. The 18 acres could remain tidal perennial aquatic with a modified tidal prism, or they could eventually be converted to one of the other tidal wetland types. For purposes of this analysis, a conservative approach has been taken and the effect has been discussed simultaneously with the habitat losses associated with other conservation measures. An estimated 65,000 acres of tidal wetlands and transitional upland would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic habitat would be restored, based on modeling conducted by ESA PWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration would be consistent with BDCP Objective TPANC1.1. Approximately 3,400 acres of the restoration would happen during the first 10 years of Alternative 1C implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal natural communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 2 acres and temporarily remove 5 acres of tidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the tidal perennial aquatic habitats directly affected. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on tidal perennial aquatic habitat. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the tidal perennial aquatic community through CM1 construction losses (25 acres permanent and 117 acres temporary) and the CM2 construction losses (8 acres permanent and 11 acres temporary). The habitat would be lost primarily along the Sacramento River at the western intake sites, at slough crossings along the western canal and tunnel alignment, or in the northern Yolo Bypass. Approximately 51 acres of the inundation and construction-related effects from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 1C implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 212 acres of restoration would be needed to offset (i.e., mitigate) the 212 acres of effect (the total permanent and temporary near-term effects listed in Table 12-1C-1) associated with near-term activities, including water conveyance facilities construction.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operation Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in relatively minor (less than 1%) conversions or losses of tidal perennial aquatic community in the study area. These losses or conversions (93 acres of permanent and 133 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation conversions would occur through the course of the Plan's restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of more than 27,000 acres of high-value tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 1C implementation would offset near-term losses associated with construction activities for CM1, CM2, CM4 and CM6, avoiding any adverse effect. Alternative 1C, which includes restoration of an estimated 27,000 acres of this natural community over the course of the Plan, would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1C would result in the loss or conversion of approximately 212 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would be primarily along the Sacramento River at western intake sites, at slough and river crossings during canal and tunnel construction, and within the northern section of the Yolo Bypass, while inundation conversions would be at various tidal restoration sites throughout the study area. The losses and conversions would be spread across the 10-year near-term timeframe. These losses and conversions would be offset by planned restoration of an estimated 3,400 acres of high-value tidal perennial aquatic natural community scheduled for the first 10 years of Alternative 1C implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less-than-significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 212 acres of restoration would be needed to offset (i.e., mitigate) the 212 acres of loss or conversions. The restoration would be initiated at the beginning of Alternative 1C implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 236 acres of the natural community would be lost or converted and an estimated 27,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1C would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Two Alternative 1C conservation measures would modify the water depths and flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation-related changes in water depth and velocity of 9–36 acres of tidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 9-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 36-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of the tidal perennial aquatic community occurs in the southern section of the bypass on Liberty Island, and, to a lesser extent, along the eastern edge of the bypass, including the Tule Canal/Toe Drain. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would be expected to be beneficial to the ecological function of tidal perennial aquatic habitat in the bypass as it relates to BDCP covered aquatic species. The Yolo Bypass waterway is the key element in the Yolo Bypass landscape linkage mapped in Figure 12-2 and described in detail in BDCP Chapter 3, Table 3.2-3. The change in periodic inundation in the bypass would not substantially modify its value for special-status or common terrestrial species. Water depths and water flow rates would increase over Existing Conditions and the No Action condition in approximately 30% of the years, but it would not fragment the habitat or make it less accessible to special-status or common terrestrial species. The modifications would not result in a loss of this community. The plant species associated with this community are adapted to inundation. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of these changes in the inundation regime on terrestrial species that rely on tidal perennial aquatic habitats are discussed in detail later in this chapter, under the individual species assessments.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of flooding of 39 acres of tidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The more

frequent exposure of these wetlands to stream flooding events would be beneficial to the ecological function of tidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The plant species associated with these tidal perennial aquatic areas are adapted to inundation and would not be substantially modified.

In summary, 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from flood flows as a result of implementing two Alternative 1C conservation measures (CM2 and CM5). Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area; therefore, periodic changes in water depth and velocity would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of tidal perennial aquatic natural community would not have an adverse effect on the community.

CEQA Conclusion: An estimated 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from inundation as a result of implementing CM2 and CM5 under Alternative 1C. Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 1C operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control* and is consistent with BDCP Objective TPANC2.1. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging.* Long-term operation of the Alternative 1C intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed later in this chapter.
- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect to the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage or value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Brackish Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no adverse effect on the habitats associated with the tidal brackish emergent wetland natural community. Habitat restoration and construction associated with CM1, CM2, CM5 and CM6 would not remove tidal brackish emergent wetland; levee breaching and minor construction associated with CM4 may temporarily remove small amounts of this natural community (see Table 12-1C-2). Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit the tidal brackish emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create at least 6,000 acres of tidal brackish emergent wetland in Conservation Zone 11 (Objective TBEWNC1.1 associated with CM4).
- Restore connectivity to isolated patches of tidal brackish emergent marsh where isolation has reduced effective use of these marshes by the species that depend on them (Objective TBEWNC1.3 associated with CM4).
- Create topographic heterogeneity in restored tidal brackish emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TBEWNC1.4 associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1 associated with CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives,* that would improve the value of tidal brackish emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-2. Changes in Tidal Brackish Emergent Wetland Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	Unk.	Unk.	Unk.	Unk.	0	0
CM5	0	0	0	0	0	0
CM6	0	0	0	0	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term

LLT = late long-term

Unk. = unknown

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction of the Alternative 1C water conveyance facilities (CM1) would not affect tidal brackish emergent wetland natural community.

Restoration of tidal marsh habitats associated with CM4 would require site preparation, earthwork, and other site activities that could remove tidal brackish emergent wetland. Levee modifications, grading or contouring, filling to compensate for land subsidence, and creation of new channels could also result in the removal of tidal brackish emergent wetland. All of this construction and land modification activity that could affect tidal brackish emergent wetland would occur in Suisun Marsh (CZ 11). The acreage of loss has not been calculated because the specific locations for site preparation and earthwork have not been identified, but the loss would likely be small (less than 1 acre). These activities would occur in small increments during the course of the CM4 restoration program. The protection and restoration elements of CM4 would greatly exceed any of the short-term losses described above. At least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area (BDCP Objective TBEWNC1.1, associated with CM4), with 2,000 acres of restoration occurring in the near-term timeframe. In addition, the habitat and ecosystem functions of BDCP restored tidal brackish emergent wetland would be maintained and enhanced (CM11). The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.3.2) states that at least 6,000 acres of tidal brackish emergent wetland community would be restored in CZ 11, and that tidal natural communities restoration would decrease habitat fragmentation by providing additional connectivity between isolated patches of tidal brackish emergent wetland. These same conservation benefits would occur under Alternative 1C.

The restoration activities associated with CM4 in Suisun Marsh would result in other effects that could alter the habitat value of tidal brackish emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Tidal flooding of dry areas could also increase the bioavailability of methylmercury in Suisun Marsh. Site-specific conditions would dictate the significance of this hazard to tidal brackish marsh vegetation and associated wildlife. According to the Suisun Marsh Plan EIR/EIS (Bureau of Reclamation et al. 2010, pg. 5.2-18), marsh creation may generate less methylmercury than is currently being generated by managed wetlands. However, this has not been confirmed through comprehensive studies. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh and the potential for increased nitrogen deposition associated with construction vehicles are also issues of concern that are difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal brackish emergent wetland in the study area.

NEPA Effects: The increase of tidal brackish emergent wetland associated with CM4 would be a beneficial effect on the natural community.

CEQA Conclusion: Tidal brackish emergent wetland natural community could experience small losses in acreage in Suisun Marsh (CZ 11) as a result of the large-scale tidal marsh restoration planned as part of CM4. These losses (not expected to exceed 1 acre) would be associated with levee modification, site preparation and other earthwork needed to expose diked lands to tidal influence. Because at least 6,000 acres of tidal brackish emergent wetland would be restored in the study area as part of CM4, including 2,000 acres restored in the near-term timeframe, there would be a large increase in tidal brackish emergent wetland both in the near-term and over the life of the Plan. Indirect effects associated with the expansion of tidal brackish emergent wetland natural community, including the potential spread of invasive species, the generation of methylmercury, increases in marsh water temperatures, and increased nitrogen deposition are not expected to have a significant impact on this natural community in the study area. Therefore, this impact would be beneficial.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with CM4 of Alternative 1C are constructed and the water management practices associated with marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions would include water releases and diversions, access road and levee repair, replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta

channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh channels would be expected to increase with reduced Sacramento River outflows (see Chapter 8, *Water Quality*), but this change would not be sufficient to change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3 for a detailed analysis of this issue). Alternative 1C, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

- Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA). *Access road and levee repair.* Periodic repair of access roads and levees associated with the BDCP actions has the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction*

Best Management Practices and Monitoring and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management in the form of physical removal and chemical treatment (CM11) would be a periodic activity associated with the long-term maintenance of restoration sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal brackish emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging.* Long-term maintenance of tidal channels that support wetland expansion in Suisun Marsh would include periodic dredging of sediments. The dredging would take place adjacent to tidal brackish emergent wetland natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value in the short term for special-status and common species that rely on it for cover, movement corridor or foraging area. The individual species effects are discussed elsewhere in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, channel dredging and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the tidal brackish emergent wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes (not exceeding 1 acre) in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand tidal brackish emergent wetland natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of small acreages of this community (see Table 12-1C-3). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the tidal freshwater emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).

- Within the 65,000 acres of tidal natural communities, restore or create at least 24,000 acres of tidal freshwater emergent wetland in Conservation Zones 1, 2, 4, 5, 6 and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Restore tidal freshwater emergent wetlands in areas that increase connectivity among conservation lands (Objective TFEWNC1.2, associated with CM4).
- Restore and sustain a diversity of marsh vegetation that reflects historical species compositions and high structural complexity (Objective TFEWNC2.1, associated with CM4).
- Create topographic heterogeneity in restored tidal freshwater emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TFEWNC2.2, associated with CM4).
- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal freshwater emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community

Table 12-1C-3. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	1	1	0	0
CM2	6	6	0	0	24–58	0
CM4	1	1	0	0	0	0
CM5	0	1	0	1	0	3
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**7**	**8**	**1**	**2**	**24–58**	**3**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 8 acres and temporarily remove 2 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add at least 24,000 acres of tidal freshwater emergent wetland natural community during the course of Plan restoration activities, which would expand the area of that habitat and offset the losses. The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.4.2) states that the implementation of *CM4 Tidal Natural Communities Restoration* would restore at least 24,000 acres of tidal freshwater emergent wetland community in Cache Slough (Conservation Zones 1, 2, and 3), the Cosumnes/Mokelumne (Conservation Zone 4), West Delta (Conservation Zone 5 and 6), and South Delta (Conservation Zone 7) ROAs. The BDCP evaluation also states that the objectives in the Plan would promote vegetation diversity and structural complexity (as incorporated into the restoration design) in restored tidal freshwater marsh. The same conservation actions would occur under Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would temporarily remove 1 acre of tidal freshwater emergent wetland community. The temporary loss would be located on Brushy Creek immediately adjacent to Byron Highway, west of Clifton Court Forebay. A temporary railroad work area would be located at this point. Refer to the Terrestrial Biology Mapbook to see the details of this location. This loss would take place during the near-term construction period.

  There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of CM1. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction or channel modification activities within the Yolo and Sacramento Bypasses, including improvements in flow through the west side channel of the bypass, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in tidal freshwater emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 6 acres could be permanently lost to these activities. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on hypothetical footprints of this restoration activity, initial land grading and levee modification could permanently remove 1 acre of tidal freshwater emergent wetland natural community. This loss would occur during the near-term timeframe in one of the ROAs identified for tidal wetland restoration. At the same time, an estimated 24,000 acres of tidal freshwater emergent wetland community would be restored during tidal habitat restoration (consistent with Objective TFEWNC1.1, associated with CM4). Approximately 8,850 acres of the restoration would happen during the first 10 years of Alternative 1C implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal wetland communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Restoration would be located and designed to improve habitat connectivity (Objective TFEWNC1.2), improve marsh species diversity (Objective TFEWNC2.1), and provide variation in inundation characteristics (Objective TFEWNC2.2). Some of the restoration would happen in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- The restoration activities associated with CM4 in the Plan Area ROAs would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal freshwater marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough, Cosumnes/Mokelumne and Suisun Marsh ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.*CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater emergent wetland habitat. The construction-related losses would be considered a permanent removal of the habitats directly affected. The majority of seasonally inundated floodplain restoration is expected to be implemented along the lower San Joaquin River in the south and central Delta areas. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on freshwater marsh and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would take place on narrow strips of habitat, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the tidal freshwater emergent wetland natural community through CM1 construction losses (1 acre temporary), CM2 construction losses (6 acres permanent), and CM4 construction losses (1 acre permanent). The tidal freshwater emergent wetland natural community would be lost on Brushy Creek, just west of Clifton Court Forebay and at various locations within the Yolo Bypass and the tidal restoration ROAs.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 1C implementation would more than offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 8 acres of restoration would be needed to offset (i.e., mitigate) the 8 acres of loss (the total permanent and temporary near-term effects listed in Table 12-1C-3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in relatively minor (less than 1%) losses of tidal freshwater emergent wetland community in the study area. These losses (8 acres of permanent and 2 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and levee modification and land grading for tidal marsh restoration (CM4) and floodplain restoration (CM5). The CM4 and CM5 losses would occur during the course of the CM4 and CM5 conservation actions at various tidal and floodplain restoration sites throughout the study area.

NEPA Effects: The creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 1C implementation would more than offset this near-term loss of constructing CM1, CM2, CM4 and CM5, avoiding any adverse effect. By the end of the Plan timeframe, a total of 24,000 acres of this natural community would be restored over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1). Therefore, Alternative 1C would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1C would result in the near-term loss of approximately 8 acres of tidal freshwater emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and tidal marsh restoration (CM4). The construction losses would be adjacent to Clifton Court Forebay, in the Yolo Bypass and at various locations undergoing tidal restoration (see Figure 12-1 for a map of ROAs) The losses would be spread across a 10-year near-term timeframe and would be offset by planned restoration of 8,850 acres of tidal freshwater emergent wetland natural community scheduled for the first 10 years of Alternative 1C implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 8 acres of restoration would be needed to offset (i.e., mitigate) the 8 acres of loss. The restoration would be initiated at the beginning of Alternative 1C implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 10 acres of tidal freshwater emergent wetland natural community would be lost to conservation activities, and 24,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1C would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal freshwater emergent wetland natural community on small acreages, while CM5 would expose this community to additional inundation as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation of 24–58 acres of tidal freshwater emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently inundated would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 24-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 58-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of this community occurs in the southern section of the bypass on Liberty Island, on the fringes of tidal perennial aquatic habitats. Smaller areas are scattered among the cropland within the bypass, south of Interstate 80. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of tidal freshwater emergent wetland habitats and would not substantially modify its value for special-status or common terrestrial species. The plants in this natural community are adapted to periodic inundation events within the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail elsewhere in this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an seasonal increase in the frequency and duration of inundation of 3 acres of tidal freshwater emergent wetland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused along the major rivers and Delta channels in the south Delta. The reconnection of these wetlands to stream flooding events would be beneficial to the wetlands' ecological function, especially as they relate to the BDCP's target terrestrial and aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5). Tidal freshwater emergent wetland natural community is a habitat of great value to both terrestrial and aquatic species in the study area.

NEPA Effects: Periodic inundation would not result in a net permanent reduction in the acreage or value of tidal freshwater emergent wetland natural community in the study area. Therefore, there would be no adverse effect.

CEQA Conclusion: An estimated 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. This community is of great value to aquatic and terrestrial species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facilities repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1C (Operational Scenario A) would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a substantial reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see BDCP Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, for a detailed analysis of this issue). Alternative 1C, which would have a 15,000 cfs diversion capacity (Operational Scenario A), would be expected to reduce the sediment load by approximately 15%, assuming that most of the sediment would be removed during high river flow periods when north Delta pumping would normally be running at or near intake capacity. This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being pumped to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (CM11). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1C intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would be done in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1C, including changed water operations in the upstream rivers, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1C-4). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the valley/foothill riparian natural community.

- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5 and CM7).
- Maintain 500 acres of mature riparian forest in Conservation Zones 4 or 7 (Objective VFRNC2.3, associated with CM3 and CM7).

- Maintain 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to late-successional riparian vegetation (VFRNC2.2), in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).
- Maintain or increase abundance and distribution of valley/foothill riparian natural community vegetation alliances that are rare or uncommon as recognized by California Department of Fish and Game (2010), such as button willow thickets alliance and blue elderberry stands alliance (Objective VFRNC3.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of valley/foothill riparian natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-4. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	40	40	86	86	0	0
CM2	89	89	88	88	51–92	0
CM4	298	552	0	0	0	0
CM5	0	43	0	35	0	266
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**427**	**724**	**174**	**209**	**51–92**	**266**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 724 acres and temporarily remove 209 acres of valley/foothill riparian natural community in the study area. These modifications represent approximately 5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would occur during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Valley/foothill riparian protection (750 acres) and restoration (800 acres) would be initiated during the same period, which would begin to offset the losses. By the end of the Plan period, 5,000 acres of this natural community would be restored. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.5.2) indicates that implementation of Alternative 4 would restore or create 5,000 acres of riparian forest and scrub in Conservation Zones 1, 2, 4, 5, 6, and 7, with at least 3,000 acres occurring on restored seasonally inundated floodplain. Alternative 4 would also protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7. These same conservation actions would occur with implementation of Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently remove 40 acres and temporarily remove 86 acres of valley/foothill riparian natural community. The habitat would be removed at multiple locations from the north Delta to the west Delta and in the vicinity of Discovery Bay. Almost all of the losses would occur on the narrow borders of waterways that are crossed by water conveyance facilities. In the north Delta, most of the permanent loss would be where Intakes W1–5 encroach on the Sacramento River's west bank from just north of Clarksburg to just north of Courtland. The riparian areas here are very small patches, some dominated by valley oak and willows, and others by nonnative trees and mixed brambles (see Terrestrial Biology Mapbook). Other small patches or narrow bands of riparian vegetation dominated by valley oak and willow would be permanently removed by canal construction and borrow areas in the vicinity of Elk Slough south of Clarksburg. A long band of mixed brambles and willows would be lost adjacent to the Sacramento River Deep Water Ship Channel, north of Miner Slough. The temporary losses of valley/foothill riparian natural community would be associated with temporary canal and siphon work areas where the canal would cross Elk Slough on the west side of Merritt Island, Duck Slough west of Courtland, Miner Slough on the northwest corner of Ryer Island, and Kellogg Creek southwest of Discovery Bay. The vegetation in these areas ranges from small stands of valley oak and willow to narrow bands of alder and mixed brambles. Small temporary losses associated with transmission line construction would occur along the entire canal/pipeline route. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 89 acres could be permanently lost and another 88 acres could be temporarily removed. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. This vegetation is a mix of valley oak, cottonwood, sycamore and willow trees. The riparian areas here are primarily small, disconnected patches with moderate to low value as wildlife movement corridors. Most of these patches lack structural complexity. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would remove similar linear strips of vegetation. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 552 acres of valley/foothill riparian community. The losses would be spread among most of the ROAs established for tidal restoration (see Figure 12-1). No losses would occur from Suisun Marsh restoration. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (BDCP Chapter 5, Section 5.4.5). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted by use of the theoretical footprint. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 43 acres and temporarily remove 35 acres of valley/foothill riparian natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration*: The valley/foothill riparian natural community would be restored primarily in association with the tidal (CM4) and floodplain (CM5) restoration and channel margin enhancements. Following community-specific goals and objectives in the Plan, a total of 5,000 acres of this community would be restored (Objective VFRNC1.1) and 750 acres would be protected over the life of the Plan. Approximately 800 acres would be restored and the entire 750 acres would be protected (Objective VFRNC1.2) during the first 10 years of Plan implementation. Riparian restoration and protection would be focused in CZs 4 and 7 (Objective VFRNC2.3), with a goal of adding a 500-acre portion of the restoration in one or the other of these zones. A variety of successional stages would also be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area (Objective VFRNC2.4).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the valley/foothill riparian natural community through CM1 construction losses (40 acres permanent and 86 acres temporary) and the CM2 construction losses (89 acres permanent and 88 acres temporary). The natural community would be lost primarily along the western bank of the Sacramento River at intake sites, along the western canal route in the northern and western Delta areas, and in the northern Yolo Bypass. Approximately 298 acres of the inundation and construction-related loss from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with BDCP conservation components. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined by Section 404 of the CWA. As indicated above, most of the losses would be in small patches or narrow strips along waterways, with limited structural complexity. However, the restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 1C implementation would minimize this near-term loss, avoiding an adverse effect. At least 400 acres of the protection is planned for the first 5 years of Alternative 1C implementation. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 601 acres of protection and 601 acres of restoration would be needed to offset (i.e., mitigate) the 601 acres of loss (the combination of permanent and temporary losses in the near-term listed in Table 12-1C-4). The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operation Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM18 Swainson's Hawk*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in approximately 5% losses of valley/foothill riparian community in the study area. These losses (724 acres of permanent and 209 acres of temporary loss) would be associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 5,000 acres of this natural community would be restored and 750 acres would be protected (CM7 and CM3, respectively). The restoration would occur primarily in CZs 4 and 7, in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

***NEPA Effects*:** The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 1C implementation would minimize the near-term loss of this community, avoiding any adverse effect. Because of the Plan's commitment to restoration of 5,000 acres and protection of 750 acres of valley/foothill riparian natural community during the course of the Plan, Alternative 1C would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1C would result in the near-term loss of approximately 601 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The natural community would be lost primarily along the western bank of the Sacramento River at intake sites, along the western canal route in the northern and western Delta areas, and within the northern section of the Yolo Bypass, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe. These losses would be minimized by planned restoration of 800 acres (CM7) and protection (including significant enhancement) of 750 acres (CM3) of valley/foothill riparian natural community scheduled for the first 10 years of Alternative 1C implementation. At least 400 acres of the protection is planned for the first 5 years of Alternative 1C implementation. AMM1, AMM2, AMM6, AMM7, AMM10 and AMM18 would also be implemented to minimize impacts. Because of these near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 601 acres of protection and 601 acres of restoration would be needed to offset (i.e., mitigate) the 601 acres of loss. The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 933 acres of valley/foothill riparian natural community would be permanently or temporarily removed by conservation actions, 5,000 acres would be restored and 750 acres would be protected. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1C would not have a substantial adverse effect on this natural community; the impact on the valley/foothill riparian natural community would be beneficial.

Impact BIO-10: Increased Frequency and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of valley/foothill riparian natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency and duration of inundation of 51–92 acres of valley/foothill riparian natural community. The area more frequently inundated would vary with the flows that would be passed through the newly constructed notch in the Fremont Weir. The 51 acres would be created by a notch flow of 8,000 cfs and the 92 acres would be created by a notch flow of 4,000 cfs. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife and Plants*. These increased flow conditions would be expected to occur in no more than 30% of all years (see BDCP Chapter 5, Section 5.4.1.2). The valley/foothill riparian community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass. There are other riparian habitat areas on Liberty Island, and, to a lesser extent, along the eastern and western edges of the bypass, including along the Tule Canal/Toe Drain, the west side channels and the Sacramento Bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect riparian habitats, as they have persisted under similar high flows and extended inundation periods in the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 266 acres of valley/foothill riparian habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The reconnection of riparian vegetation to periodic stream flooding events would be beneficial to the ecological function of this natural community, especially in the germination and establishment of native riparian plants as flood scour increases.

In summary, from 317 to 368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5). The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. The increased inundation would create a beneficial effect on the community as it relates to germination and establishment of native riparian plants.

NEPA Effects: Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial effect on the community.

CEQA Conclusion: An estimated 317 to 368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial impact on the community.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see Impact BIO-10 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with Alternative 1C, as compared with no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with Operational Scenario A) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced by as much as 19% in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 48% with implementation of Alternative 1C. Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 11–27% compared with No Action, depending on month and water-year type (see Section 11C.4 in Appendix 11C). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

  The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 1C would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1C intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat. The BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with implementation of Alternative 1C would not result in a net permanent reduction in valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on this community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration and protection activities associated with *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1C-5). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the nontidal perennial aquatic natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-5. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	22	22	21	21	0	0
CM2	24	24	12	12	50–77	0
CM4	34	189	0	0	0	0
CM5	0	28	0	16	0	25
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**80**	**263**	**33**	**49**	**50–77**	**25**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 under Alternative 1C would permanently eliminate an estimated 263 acres and temporarily remove 49 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 6% of the 5,567 acres of the community that is mapped in the study area. Approximately 36% (113 acres) of the permanent and temporary losses would happen during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 400 acres of nontidal marsh (CM10) during the same period, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh, and that the restoration would occur in blocks that would be contiguous with the Plan's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation actions would be undertaken with Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently remove 22 acres and temporarily remove 21 acres of nontidal perennial aquatic community. The permanent losses would be created by construction of the west canal where it crosses a number of north, west and south Delta waterways, including Winchester Lake just west of the Sacramento River, Medora Lake just north of Miner Slough and east of the deep water ship channel, the end of Duck Slough at Miner Slough, a small canal just south of Clifton Court Forebay, and the northern ends of the California Aqueduct and Delta Mendota Canal. Temporary losses would be created by siphon construction at Duck Slough just north of North Courtland Road and at Miner Slough just east of the deep water ship channel, and by control structure construction in the Delta Mendota Canal, (see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels modifications, Putah Creek realignment activities, and Sacramento Weir and Tule Canal improvements. All of these activities could involve excavation and grading in nontidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently lost and another 12 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently change to tidally influenced inundation or remove 189 acres of nontidal perennial aquatic community. These losses would be expected to occur primarily in the Cache Slough and Cosumnes/Mokelumne ROAs (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored. Approximately 400 acres of the restoration (CM10) would happen during the first 10 years of Alternative 1C implementation, which would coincide with the timeframe of water conveyance facilities construction and early restoration activities. The remaining restoration would be spread over the following 30 years. Nontidal natural communities restoration is expected to be focused in CZs 2, 4 and/or 5 in Figure 12-1.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would permanently remove 28 acres and temporarily remove 16 acres of nontidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the nontidal perennial aquatic habitats. It is expected that floodplain

restoration would be focused on the south part of the Plan Area, in CZ 7. Floodplain restoration along the southern Delta rivers would improve connectivity for a variety of species that rely on aquatic and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River, Middle River and Old River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would be on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. Channel margin would be enhanced within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the nontidal perennial aquatic community through CM1 construction losses (22 acres permanent and 21 acres temporary) and the CM2 construction losses (24 acres permanent and 12 acres temporary). The natural community would be lost at scattered locations along the west canal construction corridor in the north, west and south Delta and along the west side channels and channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. Approximately 34 acres of the inundation and construction-related losses from CM4 would occur during the near-term throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, creating 400 acres of nontidal marsh as part of CM10 during the first 10 years of Alternative 1C implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 113 acres of restoration and 113 acres of protection would be needed to offset (i.e., mitigate) the 113 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operation Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in relatively minor (5%) losses of nontidal perennial aquatic community in the study area. These losses (272 acres of permanent and 46 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), change to tidally influenced inundation during tidal marsh restoration (CM4), and floodplain restoration (CM5). The changes to tidally influenced inundation would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored over a wide region of the study area, including within the Cosumnes/Mokelumne, Cache Slough, and South Delta ROAs (see Figure 12-1).

***NEPA Effects*:** During the first 10 years of implementing Alternative 1C, creating 400 acres of nontidal marsh as part of CM10 would offset the construction-related and inundation losses of 113 acres of nontidal perennial aquatic natural community. There would be no adverse effect. During the full duration of Plan implementation, Alternative 1C would not result in a net reduction in the acreage of a sensitive natural community; there would be an expansion of nontidal marsh and the effect would be beneficial.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1C would result in the loss of approximately 113 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The natural community would be lost at scattered locations along the western canal construction corridor in the north, west and south Delta and along the west side channels and channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres of nontidal perennial aquatic natural community scheduled for the first 10 years of Alternative 1C implementation (CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 113 acres of restoration and 113 acres of protection would be needed to offset (i.e., mitigate) the 113 acres of loss. While the Plan does not include protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection. The restoration and protection would be initiated at the beginning of Alternative 1C implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 312 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. The nontidal marsh would consist of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1C would not have a substantial adverse effect on this natural community; the impact on the nontidal perennial aquatic natural community would be beneficial.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation of 50–77 acres of nontidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 50-acre increase in inundation would be associated with a notch flow of 3,000 cubic feet per second (cfs), and the 77-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and patches throughout the bypass, including along the Tule Canal/Toe Drain, the western channels north of Interstate 80, and below the Fremont and Sacramento Weirs. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 25 acres of nontidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The periodic flooding may also encourage the germination of nontidal marsh vegetation.

In summary, 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5). Nontidal perennial aquatic community in the Yolo Bypass has developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal perennial aquatic natural community in the Yolo Bypass and along south Delta waterways would not reduce the acreage of this natural community and could encourage germination of aquatic vegetation. This increased inundation would not be adverse.

CEQA Conclusion: An estimated 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. Nontidal perennial aquatic community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with CM1 (see Impact BIO-13 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 1C operations scheme (Operational Scenario A) would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial

aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1C-6). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the nontidal freshwater perennial emergent wetland natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal freshwater perennial emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-6. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	5	5	0	0
CM2	25	25	1	1	6–8	0
CM4	40	99	0	0	0	0
CM5	0	0	0	0	0	8
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**65**	**124**	**6**	**6**	**6–8**	**8**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 124 acres and temporarily remove 6 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 9% of the 1,509 acres of the community that is mapped in the study area. Approximately 55% (71 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 400 acres (CM10) and natural communities protection would protect 25 acres (CM3) of nontidal marsh during the same period, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in BDCP Objective NFEW/NPANC1.1 (BDCP Chapter 3, Table 3.3-2). The nontidal marsh protection would be designed to support tricolored blackbird populations in the study area. The BDCP beneficial effects analysis

(BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh. The restoration would occur in blocks that are contiguous with the alternative's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation activities would be undertaken in implementing Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would temporarily remove 5 acres of tidal freshwater perennial emergent wetland community. The temporary losses would be the result of canal siphon construction across Rock Slough near its junction with the Contra Costa Canal, and transmission corridor construction along the tunnel alignment in the west and south Delta. (see Terrestrial Biology Mapbook). These wetlands are extremely small and remote water bodies. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels and Tule Canal modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in nontidal freshwater perennial emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 25 acres could be permanently lost and 1 acre could be temporarily removed. These losses would most likely occur in the Tule Canal and west side channels at the north end of the bypass. The habitat there includes narrow bands within these side channels of the bypass and is isolated from other marsh or open water habitats. The narrow bands are bordered by riparian habitats, primarily willows and cottonwoods. This activity would occur in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 99 acres of nontidal freshwater perennial emergent wetland community. These losses would be expected to occur primarily in the Cache Slough ROA (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored (CM10) and 50 acres would be protected (CM3) during tidal habitat restoration. Approximately 400 acres of the restoration and 35 acres of the protection would occur during the first 10 years of Alternative 1C implementation, which would coincide with the timeframe of water conveyance facilities construction and early tidal marsh restoration. The remaining restoration would be spread over the following 30 years. Nontidal marsh natural communities restoration is expected to be focused in the vicinity of giant garter snake populations in the eastern Delta and near the Yolo Bypass.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would not affect nontidal freshwater perennial emergent wetland natural community.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the

enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the nontidal freshwater perennial emergent wetland community through CM1 construction losses (5 acres temporary) and the CM2 construction losses (25 acres permanent and 1 acre temporary). These losses would occur along the western canal and tunnel route at various locations, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 during the first 10 years of Alternative 1C implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 71 acres of restoration and 71 acres of protection would be needed to offset (i.e., mitigate) the 71 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operation Plan* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in 9% losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (124 acres of permanent and 6 acres of temporary loss) would be associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the CM4 restoration activities primarily at the Cache Slough ROA. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored and 50 acres would be protected. The restoration would occur near giant garter snake occupied habitat in the eastern Delta and near Yolo Bypass, in CZs 2, 4 and 5, and the protection would occur in CZ 1, 2, 8 or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: In the near-term, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 would offset the near-term losses associated with construction of CM1, CM2 and CM4 facilities, avoiding any adverse effect. With 1,200 acres of nontidal marsh restoration (BDP Objective NFEW/NPANC1.1) and 50 acres of protection (BDCP Objective TRBL1.1) included with full implementation of the Plan, Alternative 1C would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 1C would result in the loss of approximately 71 acres (the sum of the permanent and temporary near-term losses in Table 12-1C-6) of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur along the western canal route in the west and south Delta, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA mapped in Figure 12-1.

The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres and protection of 25 acres of nontidal marsh scheduled for the first 10 years of Alternative 1C implementation (CM3 and CM10). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 71 acres of restoration and 71 acres of protection would be needed to offset (i.e., mitigate) the 71 acres of loss. While the Plan includes just 35 acres of protection in the near-term, it includes in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection. The restoration and protection would be initiated at the beginning of Alternative 1C implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 131 acres of the natural community would be removed, 1,200 acres of nontidal marsh would be restored (BDCP Objective NFEW/NPANC1.1), and 50 acres of nontidal marsh would be protected (BDCP Objective TRBL1.1). There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 1C would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal freshwater perennial emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency and duration of inundation of 6–8 acres of nontidal freshwater perennial emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 6-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 8-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and isolated patches along the Tule Canal and western channel in the north end of the bypass. These areas are not connected to other adjacent marsh and open water habitats; they are surrounded by riparian habitat, scoured grassland and agricultural lands. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal freshwater perennial emergent wetland plant species in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this increased inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 8 acres of nontidal freshwater perennial emergent wetland habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal freshwater perennial emergent wetland habitats as they relate to BDCP target aquatic species. The added exposure to inundation could also encourage germination of nontidal marsh plant species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 14–16 acres of nontidal freshwater emergent perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5). This community would not be adversely affected because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

***NEPA Effects*:** The increased inundation of nontidal freshwater perennial emergent wetland natural community in the Yolo Bypass and in the southern Delta would not reduce the acreage of this natural community and could encourage germination of emergent wetland vegetation. The increased inundation would not be an adverse effect.

***CEQA Conclusion*:** An estimated 14-16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. This community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial effect on the community. The impact would be less than significant.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of

the river is tidally influenced. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM*4 *Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal freshwater perennial emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have near-term and long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of CM2 and CM4 would result in permanent removal of this community. (see Table 12-1C-7). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the alkali seasonal wetland natural community.

- Protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8 and/or 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).

- Restore or create alkali seasonal wetlands in Conservation Zones 1, 8, and/or 11 to achieve no net loss of wetted acres (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of alkali seasonal wetland natural community for terrestrial species. As explained below, with the protection, restoration, and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs and mitigation, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-7. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	13	13	9	9	0	0
CM2	45	45	0	0	264–744	0
CM4	13	27	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**71**	**85**	**9**	**9**	**264–744**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 under Alternative 1C would permanently eliminate an estimated 85 acres and temporarily eliminate an estimated 9 acres of alkali seasonal wetland complex natural community in the study area. These modifications represent approximately 3% of the 3,723 acres of the community that is mapped in the study area. Most of the losses (80 acres or 85%) would occur during the first 10 years of Alternative 1C implementation, as the water conveyance facility is constructed, Yolo Bypass improvements are initiated, and habitat restoration is initiated. Alkali seasonal wetland complex protection (120 acres) and restoration (an estimated 58 acres, but determined by actual level of effect) would be initiated during the same period; when combined, these actions would offset most of the losses. The 58 acres of restoration would be 22 acres fewer than the number of acres lost in the near-term. By the end of the Plan period, 150 acres of this natural community would be protected and up to 72 acres would be restored. The BDCP beneficial effects analysis for this community (BDCP Chapter 5, Section 5.4.7.2) states that Alternative 4 would protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, or 11, in a mosaic of protected grasslands and vernal pool complex. This would protect currently unprotected high-value alkali seasonal wetland complex in the Plan Area. These conservation measures would also be implemented under Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently eliminate 13 acres and temporarily eliminate 9 acres of alkali seasonal wetland complex natural community. The permanent losses would be caused by construction of the western canal just south of Rock Slough near Knightsen, and immediately west of Clifton Court Forebay. Temporary losses would be created by siphon work areas at both locations, and by railroad work area just west of Clifton Court Forebay (see Terrestrial Biology Mapbook). All of these losses would occur in the near-term timeframe.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Realignment of Putah Creek could involve excavation and grading in alkali seasonal wetland complex as a new channel is constructed. Based on hypothetical construction footprints, a total of 45 acres could be permanently lost. This complex is located immediately south of the existing Putah Creek channel within the bypass, and is a relatively large, moderate to high value, contiguous expanse of this community. This loss would occur in the near-term timeframe.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 150 acres of alkali seasonal wetland complex in CZs 1, 8 and 11 (Objective ASWNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13 acres of alkali seasonal wetland complex in the near-term and inundate or remove 27 acres by the end of the Plan timeframe. The losses would be expected to occur in the Cache Slough and Suisun Marsh ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the Lindsay Slough area and on the northern fringes of Suisun Marsh, north of the Potrero Hills. These losses would not fragment the alkali seasonal wetland communities adjacent to these sloughs because the losses would occur on the edges of the existing habitat.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the conservation measure is to match the acreage of restoration with the actual acreage lost to other conservation measures (primarily CM2 and CM4). The current estimate for alkali seasonal wetland complex restoration is 58 acres in the near-term and a total of 72 acres by the end of the BDCP restoration period, consistent with BDCP Objective ASWNC1.2. Restoration in the Lindsay Slough area of the Cache Slough ROA and the northern region of the Suisun Marsh ROA would be consistent with essential habitat connectivity goals mapped in Figure 12-2 and described in Table 3.2-3 of BDCP Chapter 3.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the alkali seasonal wetland complex natural community through CM1 construction losses (22 acres) and CM2 construction losses (45 acres). These losses would occur in the Yolo Bypass south of Putah Creek and on land immediately west of Clifton Court Forebay. Approximately 13 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough and Suisun Marsh ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of an estimated 58 acres of this community as part of CM9 during the first 10 years of BDCP implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 160 acres of protection and 80 acres of restoration would be needed to offset (i.e., mitigate) the 80 acres of loss. The restoration acreage would be 22 acres less than the near-term losses and the protection would be 40 acres less than typically required for this natural community. This deficit in restoration and protection would result in a near-term decrease in acreage of the natural community and would be an adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM*2 *Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in relatively minor (3%) losses of alkali seasonal wetland natural community in the study area. These losses (94 acres) would be largely associated with construction of the western canal in the south Delta area (CM1), Yolo Bypass fish improvements (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the Plan's restoration activities, primarily in the Cache Slough and Suisun Marsh ROAs.

NEPA Effects: In the first 10 years of implementing Alternative 1C conservation measures, 120 acres of alkali seasonal wetland complex would be protected as part of CM3 and up to 58 acres of this community would be restored as part of CM9. These conservation actions would not totally offset the effects of Alternative 1C actions. By the end of the Plan timeframe, a total of 150 acres of this natural community would be protected (CM3) and up to 72 acres would be restored (CM9). The protection and restoration would occur primarily in CZs 1, 8, and 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. The restoration and protection acreages contained in the BDCP would not be sufficient to provide the typical level of mitigation for this community; therefore, the effect of Alternative 1C would be adverse.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1C would result in the combined permanent and temporary loss of approximately 80 acres of alkali seasonal wetland complex natural community due to construction of the western canal and tunnel (CM1), fish passage improvements (CM2) and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily in the south Delta in CZ 8 and CZ 9 and the area just south of Putah Creek in the Yolo Bypass (CZ 2), while inundation losses would occur in the Cache Slough and Suisun Marsh ROAs. The losses would be spread across a 10-year near-term timeframe.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of up to 58 acres of this community as part of CM9 during the first 10 years of BDCP implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 160 acres of protection and 80 acres or restoration would be needed to offset (i.e., mitigate) the 80 acres of loss. AMM1, AMM2, AMM3, AMM4, AMM6, and AMM10 would also be implemented to minimize impacts. Because the offsetting protection and restoration activities contained in the BDCP do not provide for the typical level of mitigation, the near-term impact of Alternative 1C would be significant without additional mitigation. With the implementation of Mitigation Measure BIO-18, *Compensate for Loss of Alkali Seasonal Wetland Complex*, the impact would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 94 acres of alkali seasonal wetland complex natural community would be permanently removed by conservation actions, 150 acres would be protected and up to 72 acres would be restored. The restoration and protection acreages contained in the BDCP would not be sufficient to provide the typical level of mitigation for this community (188 acres of protection and 94 acres of restoration); therefore, the effect of Alternative 1C would be potentially significant. With the implementation of Mitigation Measure BIO-18, the impact would be less than significant.

Mitigation Measure BIO-18: Compensate for Loss of Alkali Seasonal Wetland Complex

To fully compensate for loss of alkali seasonal wetland complex as a result of implementing Alternative 1C, DWR shall increase near-term restoration and protection to 80 acres and 160 acres, respectively, and long-term restoration and protection to 94 acres and 188 acres, respectively.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Complex Natural Community

Under Alternative 1C, CM2 would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of alkali seasonal wetland complex natural community at scattered locations in the central and southern sections of the bypass.

Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency and duration of inundation on an estimated 264–744 acres of alkali seasonal wetland complex natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by flooding would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 264-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 744-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The alkali seasonal wetland complex natural community occurs primarily in the central and southern reaches of the bypass, south of Putah Creek. The stands in this location are relatively large, with moderate to high value for associated plant and wildlife species. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1C would not adversely affect alkali seasonal wetland complex habitats, as they have persisted under similar high flows and extended flow periods. There is the potential for some change in plant species composition as a result of longer inundation periods, but the natural community would persist.

CEQA Conclusion: An estimated 264–744 acres of alkali seasonal wetland complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1C. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of alkali seasonal wetland complex natural community in the Yolo Bypass would have a less-than-significant impact on the community. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation in and adjacent to Plan reserves. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3 Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *CM3 Natural Communities Protection and Restoration, and CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and by Mitigation Measure BIO-18, *Compensate for Loss of Alkali Seasonal Wetland Complex*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect to the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, protection actions associated with *CM3 Natural Communities Protection and Restoration* and implementation of Mitigation Measure BIO-18, *Compensate for Loss of Alkali Seasonal Wetland Complex*, would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on alkali seasonal wetland complex natural community.

Mitigation Measure BIO-18: Compensate for Loss of Alkali Seasonal Wetland Complex

See the discussion of Mitigation Measure BIO-18 under Impact BIO-18.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have a long-term adverse effect on the habitats associated with the vernal pool complex natural community, requiring mitigation. Development and construction of CM1 and CM4 would result in permanent removal of 401 acres and temporary removal of 37 acres of this community (see Table 12-1C-8). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the vernal pool complex natural community.

- Protect 600 acres of existing vernal pool complex in Conservation Zones 1, 8, and 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in Conservation Zones 1, 8, and/or 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of vernal pool complex natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs and mitigation measures, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-8. Changes in Vernal Pool Complex Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	29	29	37	37	0	0
CM2	0	0	0	0	0–4	0
CM4	201	372	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**230**	**401**	**37**	**37**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of Alternative 1C would eliminate an estimated 438 acres of vernal pool complex natural community (CM1 and CM4) in the study area. This modification represents approximately 4% of the 12,133 acres of the community that is mapped in the study area. An estimated 267 acres of the loss would occur during the first 10 years of Alternative 1C implementation, as the western canal is constructed and tidal marsh restoration is initiated. Vernal pool complex protection (400 acres) and restoration (an estimated 40 acres, with actual restoration based on level of effect) would be initiated during the first 10 years of Alternative 1C implementation, which would partially offset the losses in the near-term. By the end of the Plan period, 600 acres of this natural community would be protected and an estimated 67 acres would be restored. Because of the high sensitivity of this natural community and its shrinking presence in the Plan Area, avoidance and minimization measures have been built into the BDCP to eliminate much of this potential loss. The BDCP beneficial effect analysis (BDCP Chapter 5, Section 5.4.8.2) indicates that implementation of Alternative 4 would protect at least 600 acres of vernal pool complex in Conservation Zones 1, 8, and 11 and additional vernal pool complex would be restored to achieve no net loss of this community. These conservation measures would also be implemented for Alternative 1C.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently eliminate 29 acres and temporarily eliminate 37 acres of vernal pool complex natural community. All of these losses would be associated with western canal and related facilities construction at the south and western sides of Clifton Court Forebay. Permanent losses would be created by the canal footprint and an adjacent spoil/borrow area. The temporary losses would be created by constructing a siphon under the southern extension of Italian Slough and an adjacent fueling station/batch plant (see Figure 12-1 and the Terrestrial Biology Mapbook). All of these effects would occur in the near-term timeframe.

  Because of the close proximity of construction activity to adjacent vernal pool complex near Clifton Court Forebay, there is also the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis later in this chapter.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 600 acres of vernal pool complex in CZs 1, 8, and 11 (BDCP Objective VPNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 tidal marsh restoration in CZs 1 and 11 (Cache Slough and Suisun Marsh ROAs; see Figure 12-1) could permanently inundate or remove 201 acres of vernal pool complex in the near-term timeframe. By the end of the Plan period, a total of 372 acres could be affected. The principal areas likely to be affected include the Cache Slough drainage just west of the Yolo Bypass and the Nurse Slough drainage just east of the Potrero Hills.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool complex restoration is 40 acres in the near-term and a total of 67 acres by the end of the BDCP restoration period. This restoration conservation measure includes the “no net loss” policy normally applied to this natural community (BDCP Objective VPNC1.2).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect 267 acres of vernal pool complex natural community through inundation or construction-related losses in habitat from CM1 and CM4 activities. The majority of these losses would occur adjacent to Clifton Court Forebay as the western canal is constructed, and in the Cache Slough or Suisun Marsh ROAs mapped in Figure 12-1.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (with a commitment to have restoration keep pace with actual losses) as part of CM9 during the first 10 years of BDCP implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 534 acres of protection and 267 acres of restoration would be needed to offset (i.e., mitigate) the 267 acres of loss. The BDCP conservation measures would be 134 acres short of typical protection requirements and 227 acres short of the typical restoration requirement for full mitigation of the loss of this natural community. Alternative 1C would have an adverse effect on vernal pool complex in the near-term.

To avoid these adverse effects, the Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM*2 *Construction Best Management Practices and Monitoring, AMM*3 *Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities* and *AMM12 Vernal Pool Crustaceans.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to approximately 67 acres of direct removal and 134 acres of indirect removal of vernal pool complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With these AMMs in place, Alternative 1C would not adversely affect vernal pool complex natural community in the near-term.

Late Long-Term Timeframe

The late long-term effect on vernal pool complex natural community would be 401 acres of permanent and 37 acres of temporary loss. These losses would be associated with the construction of CM1 facilities in the vicinity of Clifton Court Forebay and the ongoing restoration of tidal wetland in the Cache Slough and Suisun Marsh ROAs. However, 600 acres would be protected (CM3) and up to 67 acres would be restored (CM9) through the course of the BDCP implementation. In addition, the avoidance and minimization measures listed above would reduce the actual loss of this community to no more than 10 wetted acres of vernal pool crustacean habitat from direct effects and 20 acres of habitat from indirect effects.

NEPA Effects: The conservation measures associated with Alternative 1C include protection of 400 acres (CM3) and restoration of an estimated 40 acres (CM9) of vernal pool complex in the near-term time frame. The Plan focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). In addition, Alternative 1C includes AMM12, which limits the removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool complex natural community. With this and other AMMs in place, Alternative 1C not adversely affect vernal pool complex natural community in the near-term. With these conservation measures and AMMs in effect through the entire Plan period, Alternative 1C would not have an adverse effect on the vernal pool complex natural community in the long term.

CEQA Conclusion:

Near-Term Timeframe

During the 10-year near-term time frame, Alternative 1C would result in the direct loss of approximately 267 acres of vernal pool complex natural community due to water conveyance construction and inundation during tidal marsh restoration (CM1 and CM4). The loss would occur in the vicinity of Clifton Court Forebay and Cache Slough or Suisun Marsh ROAs. The construction- and inundation-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (with a commitment to have restoration keep pace with actual losses) as part of CM9 during the first 10 years of Alternative 1C implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 534 acres of protection and 267 acres of restoration would be needed to offset (i.e., mitigate) the 267 acres of loss. Without additional avoidance and minimization measures to reduce the potential impact, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. However, Alternative 1C also includes AMM1, AMM2, AMM3, AMM4, AMM10, and AMM12 to minimize impacts. AMM12 places a strict limit on the acres of wetted vernal pool crustacean habitat that can be lost to conservation actions (10 acres of direct and 20 acres of indirect loss). Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 438 acres of vernal pool complex natural community would be permanently removed by conservation actions, 600 acres would be protected and up to 67 acres would be restored. The protection and restoration acreages and the implementation of AMM12 would limit the actual impact to acceptable levels. Alternative 1C would have a less-than-significant impact on vernal pool complex natural community in the late long-term timeframe.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

Under Alternative 1C, CM2 would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, could increase periodic inundation of a small acreage of vernal pool complex natural community in the southern section of the bypass, south of Putah Creek.

Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation on an estimated 0–4 acres of vernal pool complex natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 4-acre increase in inundation would only occur at the highest modeled flow regime, 8,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The vernal pool complex natural community that would likely be affected occurs in the southern reaches of the bypass, south of Putah Creek. There are several relatively large, contiguous areas of vernal pools on the western edge of the bypass in this area. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 1C water operations would not adversely affect vernal pool complex habitats, as they have persisted under similar high flows and extended flow periods. There is the potential, however, for some change in plant species composition as a result of longer inundation periods.

CEQA Conclusion: An estimated 0–4 acres of vernal pool complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 1C. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of vernal pool complex natural community in the Yolo Bypass would have a less-than-significant impact on the community.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation activities in Plan reserves. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.
- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might

adversely affect vernal pool habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, and AMM37.The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect to the community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation, or damage from recreational activity. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Managed Wetland

The conservation components of Alternative 1C would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-1C-9). Full implementation of Alternative 1C would also include the following conservation action over the term of the BDCP to benefit the managed wetland natural community.

- Protect and enhance 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

- Create 320 acres of managed wetlands consisting of greater sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in Conservation Zones 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events (Objective GSHC1.3, associated with CM10).
- Create two wetland complexes within the SLNWR refuge boundary. Each complex will consist of at least three wetlands totaling 90 acres of greater sandhill crane roosting habitat. One of the wetland complexes may be replaced by 180 acres of cultivated lands that are flooded following harvest for crane roosting and foraging habitat (Objective GSHC1.4, associated with CM10).

In addition to this conservation action, creation of similar habitat values by restoring tidal brackish emergent wetland and tidal freshwater emergent wetland as part of CM4 would further offset the losses of managed wetland. The net effect would be a substantial decrease in the amount of managed wetlands, but an increase in similar habitat value for special-status and common species as the managed wetland is converted to tidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to the *Shorebirds and Waterfowl* impacts discussion at the end of this section (Section 12.3.3.4) for further consideration of the effects of removing managed wetland natural community.

Table 12-1C-9. Changes in Managed Wetland Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	1	1	145	145	0	0
CM2	24	24	44	44	931–2,612	0
CM4	5,718	13,746	0	0	0	0
CM5	0	0	0	0	0	6
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**5,743**	**13,771**	**189**	**189**	**931–2,612**	**6**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would eliminate an estimated 13,960 acres of managed wetland in the study area. This modification represents approximately 20% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur through the course of the BDCP restoration program, as construction activity and tidal marsh restoration proceeds. Managed wetland protection (8,100 acres) and restoration (500 acres) would take place over the same period, but would not replace the acreage lost. The BDCP beneficial effects analysis for Alternative 4 (Chapter 5, Section 5.4.9.2) states that at least 8,100 acres of managed wetlands would be protected, of which at least 1,500 acres would be located within the Grizzly Island marsh complex, consistent with the U.S. Fish and Wildlife Service salt marsh harvest mouse recovery plan. Although the primary purpose of the 1,500 acres of protection is to protect and enhance habitat for the salt marsh harvest mouse, it is also expected to benefit the managed wetland natural community and the diversity of species that use it, including migratory waterfowl and the western pond turtle. These conservation measures would also be implemented under Alternative 1C.

The individual effects of the relevant conservation measures are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently remove 1 acre and temporarily remove 145 acres of managed wetland community. The permanent loss would be created by construction of the main transmission line for this alternative, which would extend westward through CZs 1 and 2 and open lands west of the Plan Area. The effect would occur approximately one mile west of Liberty Island Road. The temporary losses would occur primarily on lands just east of Miner Slough on Ryer Island. Small patches of managed wetland would be temporarily lost as a result of constructing Intake 5 adjacent to the west bank of the Sacramento River, constructing a siphon under Duck Slough just north of North Courtland Road, and constructing electrical transmission lines adjacent to the tunnel alignment and to the west of the Plan Area, west of CZ 1(see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities that could permanently or temporarily remove managed wetland, including west side channels modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in managed wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently removed and 44 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13,746 acres of managed wetland community. These losses would be expected to occur primarily in the Suisun Marsh ROA, but could also occur in the Cache Slough and West Delta ROAs (see Figure 12-1). These acres of managed wetland would be converted to natural wetland, including large acreages of tidal brackish emergent wetland and tidal freshwater emergent wetland. These natural wetlands provide comparable or improved habitat for the special-status species that occupy managed wetland. The newly created tidal marsh would not create a barrier or result in fragmentation of managed wetland, as most species are capable of utilizing both communities. An estimated 500 acres of managed wetland would be restored and 8,100 acres would be enhanced and protected through *CM3 Natural Communities Protection and Restoration*. All of the restoration and 4,800 acres of the protection would happen during the first 10 years of

Alternative 1C implementation, which would coincide with the timeframe of water conveyance facilities construction and early implementation of CM4. The remaining restoration would be spread over the following 30 years. Managed wetland restoration is expected to include at least 320 acres in CZs 3, 4, 5, and 6 (Figure 12-1) to benefit sandhill crane, as stated in BDCP Objective GSHC1.3. The enhancement and protection would be focused in Suisun Marsh, but could also occur in CZs with existing managed wetland (CZs 1, 2, 4, 5, 6, and 7).

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would permanently remove 5,743 acres and temporarily remove 189 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. An estimated 1 acre of permanent loss and 145 acres of temporary loss would be associated with construction of the water conveyance facilities (CM1). These near-term losses would occur in various locations, but the majority would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 500 acres (CM10) and protection and enhancement of 4,800 acres of managed wetland (CM3) during the first 10 years of Alternative 1C implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 146 acres of protection would be needed to offset the 146 acres of loss associated with CM1; a total of 5,932 acres of protection would be needed to offset (i.e., mitigate) the 5,932 acres of permanent and temporary loss from all near-term actions (see Table 12-1C-9). The combined protection and restoration proposed for managed wetland in the near-term would fall 632 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and

CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM*2 *Construction Best Management Practices and Monitoring, AMM*3 *Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1C, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be an adverse effect when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this adverse effect. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

Late Long-Term Timeframe

At the end of the Plan period, 13,960 acres of managed wetland natural community would be removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland.

NEPA Effects: During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would permanently remove 5,743 acres and temporarily remove 189 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Through the entire Plan period, Alternative 1C would result in a loss 13,960 acres of managed wetland within the study area; however, it would also protect and enhance 8,100 acres and restore 500 acres of this habitat. In addition, Alternative 1C would restore 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland that support similar ecological functions to those of managed wetland. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion:

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would permanently remove 5,743 acres and temporarily remove 189 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. An estimated 146 acres of this loss would be associated with construction of the water conveyance facilities (CM1). These losses would occur in various locations, but the majority of the near-term loss would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 during the first 10 years of Alternative 1C implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 146 acres of protection would be needed to offset the 146 acres of loss associated with CM1; a total of 5,932 acres of protection would be needed to offset (i.e., mitigate) the 5,932 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 632 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetlands lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM*2 *Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM*4 *Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 1C, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be a significant impact when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this significant impact. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the impacts of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Late Long-Term Timeframe

At the end of the Plan period, 13,960 acres of managed wetland natural community would be removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland. Because these natural wetlands support similar ecological functions to those of managed wetland, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of managed wetland on wildlife management areas and duck clubs scattered up and down the central and southern bypass. CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways in the south Delta.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation of 931-2,612 acres of managed wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 931-acre increase in inundation would be associated with a notch flow of 8,000 cubic feet per second (cfs), and the 2,612-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Based on the theoretical modeling that has been completed to-date, the largest acreages would be associated with the Sacramento Bypass Wildlife Area, the Yolo Bypass Wildlife Area, and private managed wetlands south of Putah Creek. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). With larger flows, the water depths may also increase over Existing Conditions. While the managed wetlands of the Yolo Bypass are conditioned to periodic inundation events, the more frequent and extended inundation periods may make it more difficult to actively manage the areas for maximum food production for certain species (waterfowl primarily) and may alter the plant assemblages in some years. The effects of this periodic inundation on birds and other terrestrial species are discussed later in this chapter. The additional inundation would not be expected to reduce the acreage of managed wetland on a permanent basis. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 6 acres of managed wetland. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The connection of these wetlands to stream flooding events would be beneficial to the ecological function of managed wetlands, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The more frequent flooding would periodically interfere with management activities associated with terrestrial species (primarily waterfowl) and may result in changes in plant composition and management strategies over time.

In summary, from 937-2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5).

NEPA Effects: Managed wetland community would not be adversely affected because much of the acreage affected is conditioned to periodic inundation. The more frequent inundation could create management problems associated with certain species, especially waterfowl, and result in changes over time in plant species composition. The total acreage of managed wetland would not be expected to change permanently as a result of the periodic inundation.

CEQA Conclusion: An estimated 937-2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. Managed wetland community would not be significantly impacted because periodic inundation is already experienced by most of the land that would be affected. There could be increased management problems and a long-term shift in plant species composition. The periodic inundation would not be expected to result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee and canal repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland

habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use managed wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow hunting, fishing and hiking in managed wetland reserve areas. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management, and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration and CM4 Tidal Natural Communities Restoration,* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in acreage of the managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM*10 Nontidal Marsh Restoration and CM4 Tidal Natural Communities Restoration, and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills, in the interior of the Potrero Hills, and in the western transmission corridor that extends west from CZ 1. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7 (Figure 12-1). The only BDCP conservation measures that would potentially affect this natural community are construction of water conveyance facilities (CM1) and seasonally inundated floodplain restoration (CM5) (see Table 12-1C-10). These conservation measures would have an adverse effect on other natural seasonal wetland complex, but with the implementation of restoration actions associated with alkali seasonal wetland complex and vernal pool complex, and Mitigation Measure BIO-27, the effects would not be adverse for NEPA purposes and less than significant for CEQA purposes.

Table 12-1C-10. Changes in Other Natural Seasonal Wetland Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	2	2	2	2	0	0
CM2	0	0	0	0	0	0
CM4	0	0	0	0	0	0
CM5	0	0	0	0	0	2
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**2**	**2**	**2**	**2**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction that would be required for implementing Alternative 1C *CM1 Water Facilities and Operation* would result in the permanent and temporary loss of other natural seasonal wetland community (2 acres permanent loss and 2 acres temporary loss). The 4-acre loss would represent less than 1% of the 842 acres of this community mapped in the study area. The losses would occur in the near-term timeframe along the permanent transmission corridor that would extend westward from the Plan Area just northwest of Rio Vista along Flannery, Goose Haven and Lambie Roads (see Terrestrial Biology Mapbook). These natural seasonal wetlands occupy low areas that extend both north and south of these roads.

Restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* would increase the amount of seasonal wetlands in the study area by 139 acres; 98 acres would be restored in the near-term. *CM3 Natural Communities Protection and Restoration* would protect 750 acres of seasonal wetland (vernal pool complex and alkali seasonal wetland complex) over the course of Alternative 1C implementation; 520 of these acres would be protected in the near-term. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 8 acres of protection and 4 acres of restoration would be needed to offset (i.e., mitigate) the 4-acre loss.

Based on theoretical footprints, *CM5 Seasonally Inundated Floodplain Restoration* could expose 2 acres of other natural seasonal wetland community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels, including the channel of Old River. The exposure of these seasonal wetlands to increased but infrequent episodes of stream flooding would not alter their ecological function or species composition. Their value to special-status and common plants and wildlife in the study area would not be affected. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

NEPA Effects: As indicated in discussion of impacts on alkali seasonal wetland complex above, the Plan does not include sufficient protection and restoration to fully offset effects created by Alternative 1C on alkali seasonal wetland complex, so its protection and restoration activity cannot be used to offset effects on other natural seasonal wetland. Similarly, vernal pool restoration provided in the Plan (up to 67 acres) is only sufficient to offset anticipated Plan effects. Vernal pool protection (600 acres) more than offsets the estimated 438-acre loss. Without additional mitigation in the form of seasonal wetland restoration, the modification of the other natural seasonal wetland natural community under Alternative 1C would have an adverse effect on other natural seasonal wetland. Mitigation Measure BIO-27, *Compensate for Loss of Other Natural Season Wetland*, is available to address this effect. The small increase in periodic flooding due to CM5 would not alter the function or general species makeup of the other natural wetland natural community and, therefore, would have no adverse effect.

CEQA Conclusion: An estimated 2 acres of other natural seasonal wetland community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing CM5 under Alternative 1C. A small seasonal increase in periodic flooding would not alter the natural community's ecological function or species composition, and the periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, increased periodic flooding due to CM5 would have a less-than–significant impact on the other seasonal wetland natural community.

Alternative 1C would eliminate 4 acres of other natural seasonal wetland complex through construction of the western transmission corridor northwest of Rio Vista. The construction loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of other natural seasonal wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 139 acres (CM9) and protection and enhancement of 750 acres (CM3) of vernal pool complex and alkali seasonal wetland complex over the course of Alternative 1C implementation would fully offset the losses associated with CM1.

Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 8 acres of protection and 4 acres of restoration would be needed to offset (i.e., mitigate) the 4 acre loss. However, because Alternative 1C would remove more vernal pool complex and alkali seasonal wetland complex than provided for in BDCP conservation measures, there would be no restoration actions that would fully offset the loss of other natural seasonal wetland. There would be a net reduction in the acreage of this natural community in the study area. Therefore, Alternative 1C would have a significant impact on other natural seasonal wetland. Implementation of Mitigation Measure BIO-27 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-27: Compensate for Loss of Other Natural Seasonal Wetland

To fully compensate for loss of other natural seasonal wetland as a result of implementing Alternative 1C, DWR shall increase the near-term and late long-term goals for restoration of seasonal wetland by 4 acres.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor. The restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the protection activities planned as part of *CM3 Natural Communities Protection and Restoration,* the mitigation measure proposed above for other seasonal wetland, and implementation of AMM2, AMM4, AMM5, and AMM10 would offset any loss of this community. The vernal pool complex conservation measure includes restoration of 139 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in the other natural seasonal wetland natural community within the study area. Therefore, there would be no adverse effect to the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, protection actions associated with *CM3 Natural Communities Protection and Restoration*, and Mitigation Measure BIO-27, *Compensate for Loss of Other Natural Seasonal Wetland*, would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Grassland

Construction, operation, maintenance and management associated with the conservation components of Alternative 1C would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would result in both permanent and temporary removal of this community (see Table 12-1C-11). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the grassland natural community.

- Protect 8,000 acres of grassland with at least 2,000 acres protected in Conservation Zone 1, at least 1,000 acres protected in Conservation Zone 8, and at least 2,000 acres protected in Conservation Zone 11 (Objective GNC1.1, associated with CM3)
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland and to provide upland habitat adjacent to riparian, tidal, and nontidal natural communities for wildlife foraging and upland refugia (Objective GNC1.2, associated with CM3 and CM8)
- Of the 8,000 acres of grassland protected and at least 2,000 acres of grassland restored, protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide 200 feet of adjacent grasslands beyond the sea level rise accommodation (Objective GNC1.4, associated with CM3 and CM8)

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of grassland natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-11. Changes in Grassland Natural Community Associated with Alternative 1C (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	358	358	320	320	0	0
CM2	388	388	239	239	385–1,277	0
CM4	448	1,122	0	0	0	0
CM5	0	51	0	34	0	514
CM6	Unk.	Unk.	Unk.	Unk.	0	0
CM7	4	410	0	0	0	0
CM11	13	50	0	0	0	0
CM18	35	35	0	0	0	0
TOTAL IMPACTS	**1,246**	**2,414**	**559**	**593**	**385–1,277**	**514**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would permanently eliminate an estimated 2,364 acres and temporarily remove 593 acres of grassland natural community in the study area. These modifications represent approximately 4% of the 78,047 acres of the community that is mapped in the study area. Approximately 60% of the permanent and temporary losses would happen during the first 10 years of Alternative 1C implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Grassland protection (2,000 acres), restoration (1,140 acres) and enhancement would be initiated during the same period, which would partially offset the losses. By the end of the Plan period, 2,000 acres of this natural community would be restored and 8,000 acres would be protected. The BDCP beneficial effects analysis for grassland (BDCP Chapter 5, Section 5.4.11.2) indicates that 8,000 acres of grasslands would be protected in Conservation Zones 1, 2, 4, 5, 7, 8, and 11, and 2,000 acres of grassland would be restored. Grassland protection and restoration would improve connectivity among habitat areas in and adjacent to the Plan Area, improve genetic interchange among native species' populations, and contribute to the long-term conservation of grassland-associated covered species. The same conservation actions would be implemented with Alternative 1C.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would permanently remove 358 acres and temporarily remove 320 acres of grassland natural community. The permanent losses would occur at various locations along the western canal route and at the intake sites along the Sacramento River. Small areas of primarily ruderal herbaceous grasses and forbs would be permanently removed at all five intakes on the west bank of the Sacramento River and along the canal route at Winchester Lake and the east bank of the Sacramento River Deep Water Ship Channel. Larger areas of annual grassland would be permanently removed by canal construction south of Rock Slough, south of Discovery Bay and immediately west of Clifton Court Forebay. Both temporary and permanent losses of grassland would be created by constructing transmission corridors west of the Plan Area and along the tunnel alignment in the west Delta. Temporary losses would be at siphon construction areas at Elk Slough, Miner Slough, Rock Slough and Italian Slough; at safe haven work areas on Bethel Island and just south of Dutch Slough; and at railroad work areas just southwest of Clifton Court Forebay (see the Terrestrial Biology Mapbook for locations). These losses would take place during the near-term construction period.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction in and around the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Toe Drain/Tule Canal and Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in grassland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 388 acres could be permanently lost and another 239 acres could be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir where a large expanse of grassland is present, along the Toe Drain/Tule Canal, and along the west side channels. These grasslands are composed primarily of upland annual grassland and forbs. Some of this grassland removal along the side channels of the bypass could pose barriers to grassland species moving within the bypass. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 448 acres of grassland in the near-term and inundate or remove 1,122 acres of grassland by the end of the Plan timeframe. The losses would occur in a number of ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Most of this grassland is ruderal and herbaceous vegetation with low habitat value; some of the larger patches of grassland in the Cache Slough ROA are annual grassland with higher values.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 51 acres and temporarily remove 34 acres of grassland natural community. The construction-related losses would be considered a permanent removal of the habitats affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). The grassland in this area is primarily composed of narrow bands and small patches of ruderal herbaceous grasses and forbs. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration;* Riparian natural community restoration would occur in a variety of settings in the Plan Area, with an emphasis on improving connectivity of existing riparian areas and stream/river corridors, to benefit the movement and interchange of special-status and common species that use these areas. Large tracts would be restored in concert with floodplain restoration (CM5), while narrower bands would be developed as part of channel margin enhancement (CM6) and tidal marsh restoration (CM4). In the process of expanding woody riparian habitat, existing nonnative grassland would be removed. While specific locations for these restoration activities have not been fully developed, use of theoretical footprints for this activity indicate that up to 410 acres of grassland could be lost through the course of Alternative 1C implementation. A majority of this activity would occur in the South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).
- *CM8 Grassland Natural Community Restoration*: The grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZs 1, 8, and 11, as proposed by BDCP Objective GNC1.1 (Figure 12-1), with a goal of improving habitat connectivity and increasing the diversity of grassland species (BDCP Objective GNC1.2). Some of the planned 2,000 acres of restoration would occur around existing populations of giant garter snake in the east Delta and the Yolo Bypass area.
- *CM11 Natural Communities Enhancement and Management:* Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the BDCP. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public's ability to participate in recreational

activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known, so the analysis of this activity is programmatic. At the current level of planning, it is assumed that the trail system would be located entirely in grassland habitats and would include up to 50 acres of habitat loss.

- *CM18. Conservation Hatcheries:* The BDCP includes a proposal to design and construct a conservation hatchery to maintain populations of delta smelt and longfin smelt. The location of this facility is not yet firmly established, but for planning purposes it has been assumed that it would be constructed in the vicinity of Rio Vista and would be located in grassland habitat. The grassland in the Rio Vista area includes both California annual grassland and ruderal herbaceous grasses and forbs. The current estimate of the land needed for this facility is 35 acres.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 1C would affect the grassland natural community through CM1 construction losses (358 acres permanent and 320 acres temporary), CM2 construction losses (388 acres permanent and 239 acres temporary), CM11 recreational trail construction (13 acres permanent), CM18 fish hatchery construction (35 acres permanent), and CM7 riparian habitat restoration (4 acres permanent). These losses would occur at Sacramento River intake sites, at various locations along the west canal corridor, along transmission corridors west of the Plan Area and along the tunnel route, in the northern Yolo Bypass, and along the east and west channels within the Yolo Bypass. Approximately 448 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see BDCP Chapter 3, *Conservation Strategy*). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses later in this chapter. The combination of restoring 1,140 acres (CM8) and protecting 2,000 acres (CM3) of grassland natural community during the first 10 years of Alternative 1C implementation, and the commitment to restore temporarily affected grassland (559 acres) to its pre-project condition within one year of completing construction as required by *AMM10 Restoration of Temporarily Affected Natural Communities*, would offset this near-term loss and avoid any loss in the availability of this habitat for special-status species. The restoration of grassland would include protection in perpetuity, and the protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (CM3 and CM11). Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,584 acres of protection would be needed to offset (i.e., mitigate) the 1,792 acres of combined temporary and permanent loss. The combination of restoration and protection, along with the enhancement and management associated with CM3 and CM11 contained in the BDCP, is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Training Awareness, AMM*2 *Construction Best Management Practices and Monitoring, AMM*6 *Disposal and Reuse of Spoils,* and *AMM*7 *Barge Operation Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 1C as a whole would result in relatively minor (less than 4%) losses of grassland natural community in the study area. These losses (2,364 acres of permanent and 593 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and riparian habitat restoration (CM7). Inundation losses would occur during the course of the Plan's restoration activities at various tidal restoration sites throughout the study area.

NEPA Effects: By the end of the Plan timeframe, a total of 2,000 acres of this natural community would be restored (CM8) and 8,000 acres would be protected (CM3). The restoration would occur primarily in CZs 1, 8, and 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity. The 2,000 acres of restoration associated with CM8, and the restoration of temporarily affected grassland required by AMM10 (593 acres for Alternative 1C) would not totally replace the grassland acres lost through the Plan timeframe (2,957 acres). There would be a permanent loss of 364 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 1C would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion:

Near-Term Timeframe

Alternative 1C would result in the loss of approximately 1,792 acres of grassland natural community due to construction of the water conveyance facilities (CM1), fish passage improvements (CM2), recreational trails (CM11) and a fish hatchery (CM18); riparian habitat restoration (CM7) and inundation during tidal marsh restoration (CM4). These losses would occur at Sacramento River intake sites, at various locations along the western canal corridor, along the western and tunnel transmission corridors, at currently unspecified sites for hatchery and recreational trail construction and riparian habitat restoration, in the northern Yolo Bypass, along the east and west channels within the Yolo Bypass, and at inundation sites at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. These losses would be offset by planned restoration of 1,140 acres of grassland (CM8), protection of 2,000 acres of grassland (CM3), and the commitment to restore temporarily affected grassland (559 acres) to its pre-project condition within one year of completing construction (required by *AMM10 Restoration of Temporarily Affected Natural Communities)*. All of these offsets would be scheduled for the first 10 years of Alternative 1C implementation. Typical project-level mitigation ratios (2:1 for protection) would indicate that

3,584 acres of protection would be needed to offset (i.e., mitigate) the 1,792 acres of loss. AMM1, AMM2, AMM6, and AMM7 would also be implemented to minimize impacts. Because of these offsetting near-term restoration and protection activities and AMMs, and because grassland is not a special-status natural community, the impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 2,957 acres of grassland natural community would be permanently or temporarily removed by conservation actions, 2,000 acres would be restored and 8,000 acres would be protected. Temporarily affected areas would also be restored (593 acres for Alternative 1C). While there would be a net permanent reduction in the acreage of this natural community within the study area (total loss of 364 acres), there would be an increase in the value of grassland for special-status and common species in the study area through the combination of conservation actions (CM3 and CM8) and avoidance and minimization measures (AMM1, AMM2, AMM6, AMM7, and AMM10). Therefore, Alternative 1C would have a less-than-significant impact on this natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Two Alternative 1C conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of grassland natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement:* Operation of the Yolo Bypass under Alternative 1C would result in an increase in the frequency, magnitude and duration of inundation of 385–1,277 acres of grassland natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 385-acre increase in inundation would occur at the 1,000 cfs flow regime, while the 1,277-acre increase would occur at the 4,000 cfs flow regime. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The grassland community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass, in stringers along the internal waterways of the bypass and in larger patches in the lower bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect grassland habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in grass species composition as a result of longer inundation periods. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 514 acres of grassland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The

increase in periodic stream flooding events would not adversely affect the habitat values and functions of grassland natural community.

In summary, from 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 1C conservation measures (CM2 and CM5).

NEPA Effects: The grasslands in the Yolo Bypass and along river floodplains in the south Delta are conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would not constitute an adverse effect.

CEQA Conclusion: An estimated 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 1C. The grassland natural community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would have a less-than-significant impact on the community.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 1C are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario A) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM11 Natural Communities Enhancement and Management.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 1C intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM8 Grassland Natural Community Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 1C would not result in a net permanent reduction in the grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 1C would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM8 Grassland Natural Community Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community includes approximately 20 acres of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1). While inland dune scrub natural community is within the BDCP Plan Area, none of the Alternative 1C conservation measures or covered actions is expected to affect this natural community.

Cultivated Lands

Cultivated lands is the major land-cover type in the study area (487,106 acres, see Table 12-1). The Delta, the Yolo Bypass and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. There are approximately 511,832 acres of cultivated lands in the study area. Tables 12-2 and 12-3 list special-status wildlife species supported by cultivated lands.

The effects of Alternative 1C on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, contains a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species later in this chapter also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses below, there is no separate analysis of this land cover type presented here. Table 14-8 in Chapter 14 provides a comparison of important farmland losses from construction of CM1 water conveyance facilities for each alternative, and Table 14A-1 in Appendix 14A, *Individual Crop Effects as a Result of BDCP Water Conveyance Facility Construction,* provides a similar comparison for losses of individual crops. Table 12-ES-1 in this chapter's Summary of Effects identifies the total cultivated land loss for all project alternatives. For Alternative 1C, the total temporary and permanent loss is estimated to be 67,895 acres. The majority of the permanent loss would be associated with habitat restoration activities, including Yolo Bypass fisheries enhancement (CM2; 629 acres), tidal marsh restoration (CM4; 39,565 acres), floodplain restoration (CM5; 2,087 acres), riparian natural community restoration (CM7; 960 acres), grassland restoration (CM8; 2,000 acres) and nontidal marsh restoration (CM10; 1,950 acres). Construction of the western canal alignment water conveyance facilities (CM1) would permanently remove 5,225 acres of cultivated land.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized here as developed lands (90,660 acres). Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities. (see Figure 12-1 and the Terrestrial Biology Mapbook). Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap provide giant garter snake habitat. As with cultivated lands, no effort has been made to analyze the effects of BDCP covered actions on this land cover type. It is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but which do not include topographic depressions that are characteristic of vernal pool crustacean habitat.

Construction and restoration associated with Alternative 1C conservation measures would result in permanent losses (see Table 12-1C-12) and indirect conversions of vernal pool crustacean modeled habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit vernal pool crustaceans (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (Objective VPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)
- Protect one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs and Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-12. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1[c]	High-value	42	42	33	33	NA	NA
	Low-value	0	0	6	6	NA	NA
Total Impacts CM1		**42**	**42**	**39**	**39**	**NA**	**NA**
CM2–CM18[b]	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**243**	**414**	**39**	**39**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 1C conservation measures would result in the direct, permanent and temporary loss of up to 453 acres modeled vernal pool crustacean habitat be from conveyance facility construction (CM1) and tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 196 acres of vernal pool crustacean habitat (140 acres of high-value habitat and 56 acres of low-value habitat) from conveyance facilities construction (CM1) and hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 1C would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool fairy shrimp (281 acres), and vernal pool tadpole shrimp (270 acres). The hypothetical tidal restoration (CM4) footprints in CZ 11 account for all of the effects on critical habitat for Conservancy fairy shrimp and vernal pool tadpole shrimp. Vernal pool fairy shrimp critical habitat would also be affected by CM4 in this same area and would be affected by conveyance facilities construction (CM1) west of Clifton Court Forebay. AMM12 Vernal Pool Crustaceans would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the covered vernal pool crustaceans. As specified in the *AMM12 Vernal Pool Crustaceans* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat would be permanently lost. *AMM12* would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology by adjacent BDCP covered activities. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by USACE to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent and temporary loss of 81 acres of vernal pool crustacean habitat (42 permanent and 39 temporary). These impacts would occur from transmission line construction in the western area of additional analysis and the construction of the canal from southeast of the town of Brentwood to the area just west of Clifton Court Forebay. These impacts would be on 45 acres of high-value habitat and 6 acres of low-value habitat. The construction of the canal west of Clifton Court Forebay would impact one CNDDB record for vernal pool fairy shrimp and the construction of the transmission line in the western area of additional analysis would result in permanent and temporary disturbance to an area with one CNDDB record for vernal pool fairy shrimp (California Department of Fish and Wildlife 2013). In addition, 61 acres of vernal pool crustacean habitat (51 acres of high-value habitat and 10 acres of low value habitat) could be indirectly affected by the construction of the CM1 canal and the transmission line within the western area of additional analysis. Approximately 11 acres of critical habitat for vernal pool fairy shrimp would be impacted by a potential borrow and spoil area west of Clifton Court Forebay. This area of impacted critical habitat does not overlap with modeled habitat for vernal pool crustaceans and a review of the BDCP natural community data shows these areas dominated by grassland and cultivated lands.
- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool crustacean habitat,

which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool crustaceans as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Game 2012). Helm (1998) notes that many vernal pool crustaceans can occur in degraded vernal pool habitats and artificial habitats. In CZs 2 and 4, there are several records of covered vernal pool crustaceans occurring outside of modeled habitat in areas that appear to be road side ditches. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool crustaceans and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool crustacean habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool crustacean habitat, which consist of 89 acres of high-value and 45 acres of low-value habitat. The hypothetical restoration footprints overlap with a CNDDB record for vernal pool fairy shrimp near the current edge of Suisun Marsh. Tidal natural community restoration under Alternative 1C would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool tadpole shrimp (270 acres), and vernal pool fairy shrimp (270 acres). *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool crustaceans (Table 12-1C-12). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values over the term of the BDCP. Human presence for recreation activities could result in the injury or mortality of, and degreation of habitat for, vernal pool crustaceans through trampling pool edges, increased turbidity, unauthorized collection, and introduction of trash. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-1C-13 was prepared to further analyze BDCP effects on vernal pool crustaceans using wetted acres of vernal pools in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan

Area, it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-1C-13. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 1C (acres)[a]

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 1C Impact[b]	CM1	12.2	12.2	9.2	9.2
	CM4[c]	30.2	55.8	11.0	20.3
Total		**42.4**	**68**	**20.2**	**29.5**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1C-12 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool crustacean habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1C-12 above lists the impacts on modeled vernal pool crustacean habitat that are based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts to vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans (see AMM12). As seen in Table 12-1C-13, the effects of CM1 alone would exceed the near-term limit and use 8 of the 10 indirect conversion effects acres allowed in the near-term. Alternative 1C would not meet the Plan's near-term biological goals and objectives for direct effects. Near-term tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 2 wetted acres of indirect conversions of vernal pools in order to meet the near-term goal for indirect effects.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 12.2 wetted acres of vernal pool crustacean habitat (or 81 acres of vernal pool complex) should be restored and 42.8 wetted acres (or 285 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1C-13, impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to avoid direct effects on wetted vernal pool acreage and not exceed 1.6

wetted acres of indirect effects. The BDCP would need to restore 12.2 wetted acres (81 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1C-13, the effects of CM1 alone would exceed 10 acres of direct effect and roughly half of the acres of indirect effects allowed under the BDCP. Alternative 1C would not meet Objective VPNC1.2 and the limits set in AMM12. For Alternative 1C to be in compliance with the indirect effects limits established under AMM12, tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 11.6 wetted acres of indirect effects on vernal pools.

The Plan has committed to a late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by the following the other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (VPNC1.4).
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (VPC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

NEPA Effects: The near-term loss of vernal pool crustacean habitat under Alternative 1C would exceed the limit for permanent and temporary impacts set by BDCP Objective VPNC1.2 and AMM12, which states the Plan would restore up to 67 acres of vernal pool complex (or 10 wetted acres of vernal pool). Though the BDCP has measures to redesign restoration projects to limit effects on covered species, it does not provide for redesigning the conveyance alignment to minimize effects. The loss of vernal pool crustacean habitat under Alternative 1C in the near-term would represent an adverse effect. Even though the Plan has a commitment to avoid and minimize effects on vernal pool crustaceans to the maximum extent practicable it is assumed that by the long-term the needs for satisfying the tidal restoration requirements (CM4) would result in additional indirect effects that could exceed the limits established by the plan. Alternative 1C would result in adverse effects on vernal pool crustaceans under NEPA over the Plan's term. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce these effects.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-1C-12 above lists the impacts on modeled vernal pool crustacean habitat that are based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans. As seen in Table 12-1C-13, the impacts of CM1 alone would exceed the near-term limit and use 8 of the 10 indirect effects acres allowed in the near-term. Alternative 1C would not meet the Plan's near-term biological goals and objectives for direct effects. Near-term tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 2 wetted acres of indirect effects on vernal pools in order to meet the near-term goal for indirect effects.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 12.2 wetted acres of vernal pool crustacean habitat (or 81 acres of vernal pool complex) should be restored and 42.8 wetted acres (or 285 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1C-13, impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to avoid direct effects on wetted vernal pool acreage and not exceed 1.6 wetted acres of indirect effects. The BDCP would need to restore 12.2 wetted acres (81 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The near-term loss of vernal pool crustacean habitat under Alternative 1C would exceed the limit for permanent and temporary impacts set by AMM12, which states that the Plan would not exceed10 wetted acres of vernal pool crustacean habitat loss. Though the BDCP has measures to redesign restoration projects to limit effects on covered species, it does not provide for redesigning the conveyance alignment to minimize effects. The loss of vernal pool crustacean habitat under Alternative 1C in the near-term would represent an adverse effect. Alternative 1C would result in a significant impacts on vernal pool crustaceans under CEQA in the near-term. Implementation of Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce impacts to a less-than-significant level.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term. As seen in Table 12-1C-13, the impacts of CM1 alone would exceed 10 acres of direct effect and would indirectly affect roughly half of the acres of indirect effects allowed under the BDCP. Alternative 1C would not meet Objective VPNC1.2 and the limits set under AMM12. For Alternative 1C to be in compliance with the indirect effects limits established under AMM12, tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 11.6 wetted acres of indirect effects on vernal pools.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (VPNC1.4).
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (VPC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

Even though the Plan has a commitment to avoid and minimize effects on vernal pool crustaceans to the maximum extent practicable it is assumed that by the long-term the needs for satisfying the tidal restoration requirements (CM4) would result in additional indirect effects that could exceed the limits established by the plan. Alternative 1C would result in a significant impacts on vernal pool crustaceans under CEQA over the Plan's term. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce this impacts to a less-than significant level.

Mitigation Measure BIO-32: Restore and Protect Vernal Pool Crustacean Habitat

To reduce the effects on modeled vernal pool crustacean habitat, DWR will ensure that there is no net loss of vernal pool wetted acreage. DWR will restore vernal pools as follows:

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

DWR will also ensure that protected vernal pool complex includes wetted vernal pool area that meets or exceeds a 2:1 ratio of protected to directly and indirectly impacted vernal pools. These protected areas will be in place prior to or concurrent with the effects. Protection will occur in CZs 1, 8, or 11, will target vernal pool recovery areas, and will be coordinated with other BDCP conservation efforts. In lieu of restoration, an equivalent amount of vernal pool restoration credit may be purchased at a USFWS- and CDFW-approved mitigation bank if the bank occurs in the Plan Area. Restoration areas, including banks where credits are purchased, will meet the following site selection criteria described below and presented in BDCP Chapter 3, Section 3.4.9.3.2.

Vernal pool restoration sites will meet the following site selection criteria.

- The site is in Conservation Zone 1, 8, or 11.
- The site has evidence of historical vernal pools based on soils, remnant topography, remnant vegetation, historical aerial photos, or other historical or site-specific data.
- The site supports suitable soils and landforms for vernal pool restoration.
- The adjacent land use is compatible with restoration and long-term management to maintain natural community functions (e.g., not adjacent to urban or rural residential areas).
- Sufficient land is available for protection to provide the necessary vernal pool complex restoration and surrounding grasslands to provide the local watershed for sustaining vernal pool hydrology, with a vernal pool density representative of intact vernal pool complex in the vicinity of the restoration site.

Acquisition of vernal pool restoration sites will be prioritized based on the following criteria.

- The site will contribute to establishment of a large, interconnected vernal pool and alkali seasonal wetland complex reserve system (e.g., adjacent to existing protected vernal pool complex or alkali seasonal wetland complex).
- The site is close to known populations of covered vernal pool species.

Impact BIO-33: Indirect Effects of Plan Implementation on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebays could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of Alternative 1C on vernal pool crustacean habitat would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the construction phase. The indirect impacts of Alternative 1C would be less-than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass under *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled vernal pool crustacean habitat (Table 12-1C-12). There would be no periodic effects resulting from *CM5 Seasonally Inundated Floodplain Restoration*

***NEPA Effects*:** BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect vernal pool crustaceans occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cubic feet per second (cfs). BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus not be adverse under NEPA.

***CEQA Conclusion*:** Alternative 1C would periodically inundate up to 4 acres of vernal pool crustacean habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of vernal pool crustacean habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus result in less-than-significant impacts on the species.

Valley Elderberry Longhorn Beetle

That habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (channels and grasslands within 200 feet of channels). Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-1C-14. The majority of the losses would take place over an extended period of time as the restoration conservation measures are being implemented. In addition, an estimated 41 elderberry shrubs could be impacted by the Alternative 1C conveyance alignment (CM1). Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit valley elderberry longhorn beetle (BDCP Chapter 3, *Conservation Strategy*).

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines for the species (Objective VELB1.1)
- Site elderberry longhorn beetle habitat restoration adjacent to occupied habitat (Objective VELB1.2)
- Restore 5,000 acres of valley/foothill riparian (Objective VFRNC1.1, associated with CM7)
- Protect 750 acres of valley/foothill riparian (Objective VFRNC1.2, associated with CM3)
- Maintain or increase the abundance and distribution of rare or uncommon vegetation alliances, such as Sambuca nigra (blue elderberry stands) alliance (Objective VFRNC3.1, associated with CM7 and CM11)

As explained below, with the restoration or protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-14. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Riparian	40	40	86	86	NA	NA
	Non-riparian	69	69	147	147	NA	NA
Total Impacts CM1		**109**	**109**	**233**	**233**	**NA**	**NA**
CM2–CM18	Riparian	381	678	76	111	44–80	266
	Non-riparian	142	311	94	108	103–244	287
Total Impacts CM2–CM18		**523**	**989**	**170**	**219**	**155–332**	**553**
TOTAL IMPACTS		**632**	**1,098**	**403**	**452**	**161–325**	**553**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 1C conservation measures would result in the permanent and temporary loss combined of up to 1,550 acres of modeled valley elderberry longhorn beetle habitat (915 acres of riparian habitat and 635 acres of nonriparian habitat), and an estimated 41 elderberry shrubs from CM1, which represent potential habitat for the species (Table 12-1C-14). Due to the limitation of the habitat suitability model, all of these effects are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Timely implementation of the near-term habitat protection and restoration contained in the Plan and implementation of AMMs committed to in the Plan would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent and temporary combined loss of approximately 342 acres of modeled valley elderberry longhorn beetle habitat, composed of 126 acres of riparian habitat and 216 acres of nonriparian habitat (Table 12-1C-14). In addition, an estimated 41 shrubs could be potentially removed as a result of conveyance facility construction. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 233 acres of modeled valley elderberry longhorn beetle habitat (86 acres riparian and 147 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, temporary access roads, and staging areas.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 295 acres of modeled valley elderberry longhorn beetle habitat, composed of 159 acres of riparian habitat and 136 acres of nonriparian habitat. Approximately 265 acres of permanent impacts (83 acres of riparian and 41 acres of nonriparian) would mostly occur at the north end of the Yolo Bypass from Fremont Weir improvements. The 170 acres of temporary impacts (76 acres of riparian and 94 acres of nonriparian) would mostly be from work on the Fremont Weir, the Sacramento Weir, and levees along the Bypass. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee modification, and removal of riprap and other protections from channel banks.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 813 acres of modeled valley elderberry longhorn beetle habitat, composed of 552 acres of riparian and 260 acres of nonriparian habitat. The majority of these impacts would be associated with tidal restoration in the Delta and only 42 acres of these impacts (all nonriparian) would be from tidal restoration in Suisun Marsh. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 101 acres of valley elderberry longhorn beetle habitat, composed of 78 acres of riparian and 23 acres of nonriparian. Approximately half of these impacts (52 acres) would be permanent impacts from levee construction and the other half (49 acres) would be temporary impacts associated with the levee construction. There is one CNDDB record of valley elderberry longhorn beetle occurring in CZ 7 just wet of Middle River on Union Island. This record and other elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee removal and modification, and removal of riprap and other protections from channel banks.
- *CM11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of BDCP protected habitats for covered species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1C would result in permanent and temporary impacts on 1,035 acres of modeled habitat (583 acres of riparian and 452 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 126 acres of riparian and 216 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 583 acres (78%) of impacts on riparian habitat. Based on the DHCCP survey data of the Conveyance Planning Area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), an estimated 41 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified as habitat for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 126 acres of the riparian habitat should be restored/created and 126 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999a). These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. *CM7 Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals and the additional species specific measures within CM7 satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigating the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 1,550 acres of modeled valley elderberry longhorn beetle habitat (915 acres of riparian habitat and 635 acres of nonriparian habitat)during the term of the Plan (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. Other factors relevant to effects on valley elderberry longhorn beetle include:

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat during the near-term evaluation period because most of the affected riparian vegetation would be removed during the near-term timeframe, while large quantities of riparian habitat would not be restored until the early and late long-term timeframes. Effects on valley elderberry longhorn beetle of this temporal loss of riparian vegetation are expected to be minimal because much of the riparian habitat in the Plan Area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation would be moved to conservation areas in the Plan Area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the Plan Area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the conservation measures or other covered activities that would result in temporary effects on natural communities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

NEPA Effects: The near-term loss of valley elderberry longhorn beetle habitat under Alternative 1C would not be adverse because the BDCP has committed to restoring and protecting an acreage that exceeds the typical mitigation ratios described above, in addition to avoiding impacts on shrubs and transplanting those that can't be avoided. In the absence of other conservation actions, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 1C in the late long-term would represent an adverse effect. However, with habitat protection and restoration associated with CM7, guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the construction period, the effects of Alternative 1C as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 1C would result in permanent and temporary impacts on 1,035 acres of modeled habitat (583 acres of riparian and 452 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These impacts would result from the construction of the water conveyance facilities (CM1, 126 acres of riparian and 216 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 583 acres (78%) of impacts on riparian habitat. Based on the DHCCP survey data of the Conveyance Planning Area, an estimated 41 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 126 acres of the riparian habitat should be restored/created and 126 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term impacts of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999a). These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. CM7 specifically calls for the planting of elderberry shrubs in in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs, are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary impacts on 1,550 acres of modeled valley elderberry longhorn beetle habitat (915 acres of riparian habitat and 635 acres of nonriparian habitat)during the term of the Plan (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. The BDCP also includes a number of AMMs (AMM1–AMM6, AMM10, and AMM15) directed at minimizing or avoiding potential impacts on valley elderberry longhorn beetle. The large acreages of conservation would adequately compensate for the modeled habitats lost to construction and restoration activities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as others actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1C as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on valley elderberry longhorn beetle over the term of the BDCP. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis (see Section 12.3.2.3 for a discussion on the methods used to make this estimate) estimates that approximately 12 shrubs could be indirectly affected by conveyance facilities construction (CM1). Restoration activities could result in excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15, which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 1C conservation actions would not have an adverse effect on valley elderberry longhorn beetle.

CEQA Conclusion: Ground-disturbing activities, stockpiling of soils, and the potential release of dust and hazardous substances would accompany construction of the water conveyance facilities. An estimated 12 shrubs could be indirectly affected by conveyance facilities construction (CM1). In addition, ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks could indirectly affected elderberry shrubs that occur within 100 feet of these restoration activities. With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse indirect effects on valley elderberry longhorn beetle in that the Plan would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 161 to 325 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1C-14). *CM5 Seasonally Inundated Floodplain Restoration* would periodically inundate 553 acres of modeled valley elderberry longhorn beetle habitat (Table 12-1C-14).

It is unknown at this time how much of the modeled habitat that would be inundated as a result of CM2 and CM5 actually contains elderberry shrubs. Elderberry shrubs have been found to be intolerant of long periods of inundation and there is evidence that they die very quickly after even short periods of flooding (River Partners 2008). During monitoring of a restoration project at the San Joaquin River National Wildlife Refuge, River Partners found that nearly all (99% to 100%) of the 4-year-old elderberry shrubs in restoration plots died after 15-17 weeks of inundation, and River Partners noted in general that the shrubs died very quickly after even short periods of flooding (River Partners 2008). Talley et al (2006) in their report assisting the USFWS 5-year review of the species, note that elderberry shrubs respond negatively to saturated soil conditions and that they can only tolerate temporary root crown inundation. Therefore, in the areas that would be periodically inundated by the implementation of CM2 it is likely that there are few, if any, mature shrubs in these areas because under current conditions they would be inundated in about 50% of all years for approximately 7 weeks. The areas affected by CM5 are not currently inundated and thus elderberry shrubs could present in these areas.

The periodic effects on modeled habitat for valley elderberry longhorn beetle associated with implementing Alternative 1C could adversely affect valley elderberry longhorn beetle habitat (elderberry shrubs) and make modeled habitat there unsuitable for future elderberry establishment. Based on the information presented above, the current conditions in those areas that would be periodically inundated in Yolo Bypass (CM2) are not likely very suitable for elderberry shrubs and, thus, CM2 would likely have minimal effects, if any, on the species. The modeled habitat that would be periodically inundated from the implementation of CM5 could result in adverse effects on valley elderberry longhorn beetle.

NEPA Effects: Periodic effects of the inundation of valley elderberry longhorn beetle habitat as a result of implementing Alternative 1C conservation actions would not be adverse under NEPA when taking into consideration CM7 habitat protection and restoration. This habitat protection and restoration would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the time period when periodic effects would occur.

CEQA Conclusion**:** Alternative 1C (CM2 and CM5) would have periodic impacts on modeled valley elderberry longhorn beetle habitat. The periodic inundation of between 161 and 325 acres (CM2) and 553 acres (CM5) of modeled habitat could result in the death of elderberry shrubs that may occur there and thus potentially impact valley elderberry longhorn beetle. The Plan includes the restoration of 5,000 acres of riparian habitat (Objective VFRNC1.1) and the protection of 750 acres riparian habitat (Objective VFRNC1.2) would include areas for elderberry restoration and protection. The BDCP also includes AMM1–AMM6, AMM10, and AMM15 that would minimize and avoid impacts on valley elderberry longhorn beetle prior to Yolo Bypass fisheries enhancement and floodplain restoration activities. AMM15, which includes a measure for following the USFWS conservation guidelines for valley elderberry longhorn beetle, would be used to identify shrubs for transplanting to conservation areas that otherwise could be adversely affected by periodic inundation in Yolo Bypass and floodplain restoration areas (U.S. Fish and Wildlife Service 1999a). These conservation actions would compensate for the periodic impacts on valley elderberry longhorn beetle.

Considering these protection and restoration provisions and avoidance and minimization measures, implementation of Alternative 1C as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, periodic effects of inundation resulting from Alternative 1C would have a less-than-significant impact on valley elderberry longhorn beetle.

Nonlisted vernal pool invertebrates

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on nonlisted vernal pool invertebrates that are not covered by the Plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but do not include topographic depressions that are characteristic of vernal pools.

Construction and restoration associated with Alternative 1C conservation measures would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-1C-15 and indirect conversions of vernal pool habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP that would benefit nonlisted vernal pool invertebrates (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (ObjectiveVPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (ObjectiveVPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)

However, as explained below the impacts on nonlisted vernal pool invertebrates would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1C-15. Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	42	42	33	33	NA	NA
	Low-value	0	0	6	6	NA	NA
Total Impacts CM1		**42**	**42**	**39**	**39**	**NA**	**NA**
CM2–CM18	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**243**	**414**	**39**	**39**	**0–4**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 1C conservation measures would result in the direct permanent loss of up to 453 acres of vernal pool habitat from conveyance facility construction (CM1) and tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 196 acres of vernal pool habitat (140 acres of high-value habitat and 56 acres of low-value habitat) from conveyance facilities construction (CM1) and tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute a possible conversion of the habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the covered vernal pools. As specified in the BDCP, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool habitat would be permanently lost. *AMM12 Vernal Pool Crustaceans* would ensure that no more than 20 wetted acres of vernal pool habitat are indirectly affected by BDCP covered activities. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by USACE to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is comprised of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent and temporary loss of 81 acres of vernal pool habitat (42 permanent and 39 temporary). These impacts would occur from transmission line construction in the western area of additional analysis and the construction of the canal from southeast of the town of Brentwood to the area just west of Clifton Court Forebay. These impacts would be on 45 acres of high-value habitat and 6 acres of low-value habitat. In addition, 61 acres of vernal pool habitat (51 acres of high-value habitat and 10 acres of low-value habitat) could be indirectly affected by the construction of the CM1 canal and the transmission line within the western area of additional analysis.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for nonlisted vernal pool invertebrates. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for nonlisted vernal pool invertebrates and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied nonlisted vernal pool invertebrate habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool habitat, which consist of 89 acres of high-value and 45 acres of low-value habitat. No records of nonlisted vernal pool invertebrates would be directly impacted by CM4.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool invertebrates (Table 12-1C-15). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-1C-16 was prepared to further analyze BDCP effects on vernal pools using wetted acres of vernal pools in order to compare to the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, which are measured in wetted acres of vernal pools. Wetted acres were estimated by using the BDCP's assumption that vernal pool and degraded vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area, it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-1C-16. Estimated Effects on Wetted Vernal Pools Associated with Alternative 1C (acres)[a]

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit		5	10	10	20
Alternative 1C Impact[a]	CM1	12.2	12.2	9.2	9.2
	CM4[b]	30.2	55.8	11.0	20.3
Total		**42.4**	**68.0**	**20.2**	**29.5**

[a] Because roughly half of the impacts occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-1C-15 has densities of wetted vernal pools at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-1C-15 above lists the impacts on vernal pool habitat that are based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on nonlisted vernal pool invertebrates (see AMM12). As seen in Table 12-1C-16, the effects of CM1 alone would exceed the near-term limit and use 9 of the 10 indirect effects acres allowed in the near-term. Alternative 1C would not meet the Plan's near-term biological goals and objectives for direct effects. Near-term tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 2 wetted acres of indirect effects on vernal pools in order to meet the near-term goal for indirect effects.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 12.2 wetted acres of vernal pools (or 81 acres of vernal pool complex) should be restored and 42.8 wetted acres (or 285 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1C-16, impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to avoid direct effects on wetted vernal pool acreage and not exceed 1.6 wetted acres of indirect effects. The BDCP would need to restore 12.2 wetted acres (81 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The Plans biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-1C-16, the effects of CM1 alone would exceed 10 acres of direct effect and roughly half of the acres of indirect effects allowed under the BDCP. In order for Alternative 1C to meet the biological goals and objectives of the Plan, tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 11.6 wetted acres of indirect effects on vernal pools.

The Plan has committed to a late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1,1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).

NEPA Effects: The near-term loss of vernal pool habitat under Alternative 1C would exceed the limit for permanent and temporary impacts set by BDCP Objective VPNC1.2, which states the Plan would restore up to 67 acres of vernal pool complex (or 10 wetted acres of vernal pool). Though the BDCP has measures to redesign restoration projects to limit effects to natural communities and species it does not provide for redesigning the conveyance alignment to minimize effects. The loss of nonlisted vernal pool species habitat under Alternative 1C in the near-term would represent an adverse effect. Even though the Plan has a commitment to avoid and minimize effects on vernal pools to the maximum extent practicable it is assumed that by the long-term the needs for satisfying the tidal restoration requirements (CM4) would result in additional indirect effects that could exceed the limits established by the plan. Alternative 1C would result in adverse effects on nonlisted vernal pool species under NEPA over the Plan's term. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce these effects.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-1C-15 above lists the impacts on vernal pool habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools. As seen in Table 12-1C-16, the effects of CM1 alone would exceed the near-term limit and use 9 of the 10 indirect effects acres allowed in the near-term. Alternative 1C would not meet the Plan's near-term biological goals and objectives for direct effects. Near-term tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 2 wetted acres of indirect effects on vernal pools in order to meet the near-term goal for indirect effects.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 12.2 wetted acres of vernal pools (or 81 acres of vernal pool complex) should be restored and 42.8 wetted acres (or 285 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool habitat. Assuming that the BDCP would apply the impact limits presented in Table 12-1C-16, impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to avoid direct effects to wetted vernal pool acreage and not exceed 1.6 wetted acres of indirect effects. The BDCP would need to restore 12.2 wetted acres (81 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects to vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The near-term loss of nonlisted vernal pool species habitat under Alternative 1C would exceed the limit for permanent and temporary impacts on wetted vernal pool acreage set by BDCP Objective VPNC1.2, which states that the Plan would restore up to 67 acres of vernal pool complex (or 10 wetted acres of vernal pool). Though the BDCP has measures to redesign restoration projects to limit effects to natural communities and species it does not provide for redesigning the conveyance alignment to minimize effects. The loss of nonlisted vernal pool species habitat under Alternative 1C in the near-term would represent an adverse effect. Alternative 1C would result in a significant impacts on nonlisted vernal pool species under CEQA in the near-term. Implementation of Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce impacts to a less-than-significant level.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the late long-term. As seen in Table 12-1C-16, the effects of CM1 alone would exceed 10 acres of direct effect and roughly half of the acres of indirect effects allowed under the BDCP. In order for Alternative 1C to meet the biological goals and objectives of the Plan, tidal restoration projects would have to be designed to ensure that there are no direct effects on wetted vernal pool acreage (permanent or temporary) and no more than 11.6 wetted acres of indirect effects on vernal pools.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following these other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

Even though the Plan has a commitment to avoid and minimize effects on vernal pool habitats to the maximum extent practicable it is assumed that by the long-term the needs for satisfying the tidal restoration requirements (CM4) would result in additional indirect effects that could exceed the limits established by the plan. Alternative 1C would result in a significant impacts on nonlisted vernal pool species under CEQA over the Plan's term. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, would reduce this impacts on a less-than significant level.

Mitigation Measure BIO-32: Restore and Protect Vernal Pool Crustacean Habitat

See Mitigation Measure BIO-32 under Impact BIO-32.

Impact BIO-39: Indirect Effects of Plan Implementation on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Nonlisted vernal pool invertebrates and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebays could result in the inadvertent discharge of sediments and hazardous materials into vernal pool habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of Alternative 1C implementation would not be adverse.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the Plan's construction phase. The indirect impacts of Alternative 1C would be less than significant.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass under *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled habitat for nonlisted vernal pool invertebrates (Table 12-1C-15). There would be no periodic effects resulting from *CM5 Seasonally Inundated Floodplain Restoration*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect nonlisted vernal pool invertebrates occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus not be adverse.

CEQA Conclusion: Alternative 1C would periodically inundate up to 4 acres of nonlisted vernal pool invertebrates' habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of nonlisted vernal pool invertebrates' habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus result in less-than-significant impacts on the species.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes inland dune scrub habitat at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 1C would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance construction would not affect inland dune scrub at Antioch Dunes NWR. No dredge spoil areas that could be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 1C water intake facilities on aerial imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of Alternative 1C restoration-based conservation measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the Plan Area is at Antioch Dunes, which would not be impacted by the Alternative 1C conservation measures. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of BDCP restoration actions, and other covered activities could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the Plan Area; however the extent of these habitats in the Plan Area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Over the term of the BDCP, Alternative 1C would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 1C objectives would generally increase opportunities for the formation of sandbars in the Plan Area.

- Restore 10,000 acres of seasonally inundated floodplain (Objective L2.11, associated with CM5),
- Enhance 20 miles of channel margin habitat (Objective L2.12, associated with CM6),
- Restore 5,000 acres of riparian habitat, with at least 3,000 acres occurring on restored seasonally inundated floodplain. (VFRNC1.1, associated with CM7).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins and in floodplains, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins and floodplains would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-17. Changes in Sacramento and Antioch Dunes Anthicid Beetle Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 1C conservation measures could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur along to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of aerial Google Earth imagery of the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery of the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Conservation measures that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal natural communities restoration (CM4), seasonally inundated floodplain restoration (CM5), and channel margin enhancement (CM6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The West Delta ROA has been identified in the BDCP (BDCP Chapter 3, Section 3.4.4, *Conservation Measure 4 Tidal Natural Communities Restoration*) as providing opportunities for creating subtidal aquatic and tidal marsh habitats. The methods and techniques identified in the BDCP that may be used for tidal restoration include the recontouring of lands so that they have elevations suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.

- *CM5 Seasonally Inundated Floodplain Restoration*: Seasonally inundated floodplain restoration could impact areas with sandbars that were identified in a review of aerial photographs. The sandbars identified along the San Joaquin River and Paradise Cut are within the conceptual corridors (Corridors 1a, 1b, 2a, and 4) identified in Figure 3.4-20 of the BDCP. There are four CNDDB records for Sacramento anthicid beetle in the conceptual corridor along the San Joaquin River (California Department of Fish and Wildlife 2013). Floodplain restoration actions in these conceptual corridors could impact potential habitat for both these species and occupied habitat of Sacramento anthicid beetle.
- *CM6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 20 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 1C could result in substantial affects to Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which is being considered for tidal restoration (CM4), or within three of the conceptual corridors being considered for floodplain restoration (CM5). Furthermore, all seven of the records for Sacramento anthicid beetle within the study area fall within areas being considered for restoration (CM4 and CM5), which represent over half of the extant records for this species range wide (7 of 13), and the only extant record for Antioch Dunes anthicid beetle, which represent one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected by restoration if these areas are choses as restoration projects. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. CM5, CM6, and CM7 would generally contribute to the formation of sandbar habitat in the Plan Area. These measures would improve shoreline conditions by creating benches along levees (CM6), creating shallow margin and floodplain habitat (CM5), and increasing shoreline vegetation (CM7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form. Three other factors are relevant to effects on Sacramento and Antioch Dunes anthicid beetles.

- The actual extent of suitable and occupied habitat for these species in the plan is unknown.

- The sandbar habitat occupied by Sacramento anthicid beetle along the San Joaquin River would likely not be directly impacted where floodplain restoration occurs because the physical disturbance would be to adjacent levees and agricultural areas. Though these actions would change hydrologic conditions that could overtime remove the existing sandbars, the expanded floodplain would create conditions suitable for the formation of new and possibly larger sandbars.

- Floodplain restoration would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

NEPA Effects: The potential impacts on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 1C as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with implementation of restoration associated with CM5, CM6, and CM7, which would be phased throughout the time period when the impacts would be occurring, the effects of Alternative 1C as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion: Alternative 1C would impact Sacramento and Antioch Dunes anthicid beetle habitat and could impact seven occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. BDCP conservation components, particularly conservation measures CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. Floodplain restoration (CM5) would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

Considering that floodplain (CM5), channel margin enhancement (CM6), and riparian restoration (CM7) would contribute to the replacement of and possible expansion of sandbar habitat in the Delta and be phased throughout the time period when the impacts would be occurring, the implementation of Alternative 1C as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than significant impact on Sacramento and Antioch Dunes anthicid beetle.

Delta Green Ground Beetle

Suitable habitat for delta green ground beetle in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1C would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 1C could affect delta green ground beetle through the protection of grasslands and vernal pool complex (CM3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions and recreational trail construction (CM11) in these areas. In addition, tidal natural communities restoration (CM4) and vernal pool and alkali seasonal wetland complex restoration (CM9) could result in potential impacts on delta green ground beetle and its habitat. Full implementation of Alternative 1C would likely result in beneficial effects on delta green ground beetle through the following conservation actions.

- Protect 2,000 acres of grassland in CZ 1 (Objective GNC1.1, associated with CM3).
- Protect 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1, associated with CM3).
- Restore up to 67 acres of vernal pool complex in CZs 1, 8, and/or 11 (Objective VPNC1.2, associated with CM9).

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1C-18. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 1C conservation measures could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Conservation measures that could affect delta green ground beetle include tidal natural communities habitat restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and habitat enhancement and management activities (CM11) in CZ 1. CZ 1 is the only portion of the Plan Area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, SR 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; U.S. Fish and Wildlife Service 2009). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *CM4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. CM4 identifies 5,000 acres of freshwater tidal natural communities restoration in the Cache Slough ROA and Lindsey Slough and Calhoun Cut have been identified as areas suitable for restoration. Lindsey Slough is just west of Jepson Prairie and Calhoun Cut, which is off of Lindsey Slough (see Figure 12-1), goes into the general Jepson Prairie area and is adjacent to areas of potential habitat for delta green ground beetle. The tidal restoration methods and techniques identified in CM4 (see BDCP Chapter 3, Section 3.4.4.3.3) include excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affects delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species. No CNDDB records for delta green ground beetle are intersected by the hypothetical tidal restoration footprints being used by the BDCP.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle. However, if these activities do take place in suitable habitat, then disturbances could result in direct mortality of the species. Still, restoration ultimately would expand habitat available to the species.
- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 1 and a portion of the 600 acres of protection and possibly some of the up to 10 wetted acres of vernal pool restoration could also occur in CZ 1. Potential effects from CM11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of CM11 would result in impacts on 15.5 acres of grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The protection of 2,000 acres of grassland in CZ 1 (CM3) and the protection of 600 acres of vernal pool complex and up 10 wetted acres of vernal pool complex restoration, some of which could occur in CZ 1 (CM3 and CM9) could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle.

The management of these grasslands and vernal pool complexes according to CM11 *Natural Communities Enhancement and Management* and the construction of recreational trails in CZ 1 has a potential to affect this species. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Direct mortality and/or the affects to delta green ground beetle habitat would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-42 would reduce this effect.

CEQA Conclusion: The implementation of grassland and vernal pool complex protection (CM3), tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from CM11 could include direct mortality to larvae and adults resulting from the implementation of recreation trail construction in 15.5 acres of grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and therefore result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42 would reduce these potential impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areasin the area of Jepson Prairie, BDCP proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.
- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing covered activities in these areas will be avoided, which for the Plan Area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta

green ground beetle. No ground disturbing covered activities will occur in areas identified as occupied by delta green ground beetle.

- Based on the results of the habitat evaluations and surveys, site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

Suitable habitats for callippe silverspot butterfly are typically in areas influenced by coastal fog with hilltops that support the species' host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldeneaster, coast buckwheat, mourning bride, and California buckeye. The construction, and operations and maintenance of the water conveyance facilities under Alternative 1C would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *CM3 Natural Communities Protection and Restoration,* the subsequent implementation of *CM11 Natural Communities Enhancement and Management* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the Plan Area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Though CZ 11 has been identified as potential area for grassland restoration in *CM8 Grassland Natural Community Restoration,* the primary goal there is to restore small patches of grassland to connect to Jepson Prairie and/or the restoration of upland grasses adjacent to tidal brackish emergent wetland in Suisun Marsh, both of which would not be areas suitable for callippe silverspot butterfly. The full implementation Alternative 1C would protect up to 2,000 acres of grassland in CZ 11 (Objective GNC1.1, associated with CM3), some of which may contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-1C-19. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
[e] Restored/created and protected habitat acreages represent planned conservation activities that would be implemented over the lifetime of the BDCP (see BDCP Chapter 3, *Conservation Strategy*, for specifics).
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 1C conservation measures could result in the conversion of habitat and/or direct mortality to callippe silverspot butterfly. Only one conservation measure was identified as potentially affecting callippe silverspot butterfly, *CM11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *CM3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of 2,000 acres of grassland within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. The management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *CM3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has affect this species. Potential impacts from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults resulting from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, which could result in direct and indirect effects on larval host plants and nectar plants. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would therefore result in significant impacts on the species under CEQA. However, over the term of BDCP callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and thus reduce the potential impacts on a less-than-significant level.

Mitigation Measures BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, BDCP proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and

identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.

- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-1C-20. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP to benefit the California red-legged frog (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11, CM13, and CM20).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3)
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-20. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	1	1	1	1	NA	NA
	Upland	61	61	10	10	NA	NA
Total Impacts CM1		**62**	**62**	**11**	**11**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	8	24	0	0	0	0
Total Impacts CM2–CM18		**8**	**24**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**70**	**86**	**11**	**11**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 1C conservation measures would result in the permanent and temporary loss combined of up to 2 acres of modeled aquatic habitat and 95 acres of modeled upland habitat for California red-legged frog (Table 12-1C-20). There is one California red-legged frog occurrence that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction (CM1) and recreational facility construction for CM11. Construction activities associated with the water conveyance facilities and recreational facilities, including operation of construction equipment, could result in temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C, including transmission line construction, would result in the permanent loss of up to 1 acre of aquatic habitat and 61 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-1C-20). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 1 acre of aquatic habitat and 10 acres of upland habitat for the California red-legged frog (Table 12-1C-20).

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 4, *Covered Activities and Associated Federal Actions*, an estimated 24 acres of upland cover and dispersal habitat for the California red-legged frog would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California red-legged frog are expected to be minimal.

  Activities associated with natural community enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs discussed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog.

- Critical habitat: Several conservation measures would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Conservation actions to protect and enhance grassland habitat for covered species, including California red-legged frog, in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation conservation actions and AMM1–AMM6, AMM10, AMM14, and AMM37, described below, would reduce these effects.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of

California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1C would permanently remove approximately 2 acres of aquatic habitat and 79 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 73 acres) and recreational facilities (CM11, 8 acres).

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 158 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM14 California Red-Legged Frog, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic and 7,766 acres of upland habitat for California red-legged frog. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 2 acres of aquatic habitat and 79 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 2% of the total habitat in the study area). The 2 acres of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

NEPA Effects: In the near-term, the loss of California red-legged frog habitat under Alternative 1C would be not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 1C as a whole on California red-legged frog would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 1C would permanently remove approximately 2 acres of aquatic habitat and 79 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 73 acres) and recreational facilities (CM11, 8 acres).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 158 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical

mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1-AMM6, AMM10, AMM14, and AMM37. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C on California red-legged frog would be less than significant, because the number of acres required to meet the typical ratios described above would be only 1 acre of aquatic habitat restored, 1 acre of aquatic habitat protected, and 158 acres of upland communities protected.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic and 7,766 acres of upland habitat for California red-legged frog. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 2 acres of aquatic habitat and 79 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and 2% of the total habitat in the study area). The 2 acres of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

In the absence of other conservation actions, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 1C would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 1C would have a less-than-significant impact on California red-legged frog.

Impact BIO-45: Indirect Effects of Plan Implementation on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted in this area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

Noise and visual disturbance outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted in this area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

***NEPA Effects*:** Implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 1C would avoid the potential for substantial adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on California red-legged frog.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance, as well as construction-related noise and visual disturbances including artificial nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, construction, operation, and maintenance under Alternative 1C would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 1C would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While conservation measures implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 1C is expected to result in the temporary, permanent, and periodic removal of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-1C-21). While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP to benefit the California tiger salamander (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).

- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and CZ 11, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).
- Increase the size and connectivity of protected vernal pool complex within the Plan Area and increase connectivity with protected vernal pool complex adjacent to the Plan Area (Objective VPNC1.3, associated with CM3).
- Protect the range of inundation characteristics that are currently represented by vernal pools throughout the Plan Area (Objective VPNC1.4, associated with CM3).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-21. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic	2	2	2	2	NA	NA
	Upland	70	70	8	8	NA	NA
Total Impacts CM1		**72**	**72**	**10**	**10**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	292	634	0	0	191–639	0
Total Impacts CM2–CM18		**292**	**634**	**0**	**0**	**191–639**	**0**
TOTAL IMPACTS		**364**	**706**	**10**	**10**	**191–639**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 1C conservation measures would result in the permanent and temporary loss combined of up to 4 acres of modeled aquatic habitat and 712 acres of modeled upland habitat for California tiger salamander (Table 12-1C-21). There is one California tiger salamander occurrence that overlaps with the CM1 footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal natural community restoration (CM4), construction of recreational facilities (CM11), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California tiger salamander habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities, including transmission lines, would result in the permanent loss of 2 acres of aquatic habitat and 70 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-1C-21). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 2 acres of aquatic habitat and 8 acres of upland habitat for the California tiger salamander (Table 12-1C-21). In addition, there is one California tiger salamander occurrence just west of Clifton Court Forebay that overlaps with the area of temporary effects. The area that would be affected by conveyance facilities construction is south of Clifton Court Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent removal of approximately 42 acres of terrestrial cover and aestivation habitat for the California tiger salamander in the late-longterm. The modeled habitat in the Yolo Bypass is of low potential for California tiger salamander: There have been no observations of California tiger salamander in this area based on the results of a number of surveys for vernal pool invertebrates and plants and the bypass lacks vernal pool complexes with large, deep pools or large grassland areas with stock ponds and similar aquatic features that hold water long enough to provide potential breeding habitat for this species.

- *CM4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of approximately 517 acres of terrestrial cover and aestivation habitat in the study area in the late longterm. Tidal restoration in the Cache Slough area would result in habitat loss along the edges of Lindsey Slough and Duck Slough, and adjacent to cultivated land along the eastern edge of a block of modeled habitat. The modeled aquatic breeding habitat nearby the hypothetical tidal restoration footprint is of relatively high value, consisting of vernal pool complex along Lindsey Slough within the Jepson Prairie area in and near open space. The Jepson Prairie area includes numerous California tiger salamander CNDDB recorded occurrences and overlaps with Critical Habitat Unit 2, Jepson Prairie Unit, for this species; however, the hypothetical tidal restoration footprint does not overlap with critical habitat or recorded occurrences in this area. The tidal restoration at Lindsey Slough would occur along the northeastern edge of the Jepson Prairie block of habitat and would not contribute to fragmentation. Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because of the ability to select sites that minimize effects on California tiger salamander.

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 3, *Conservation Strategy*, an estimated 40 acres of California tiger salamander terrestrial cover and aestivation habitat, primarily in CZ 8, would be removed in the late long-term as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California tiger salamander are expected to be minimal.

Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values over the term of the BDCP. Activities associated with natural community enhancement and management over the term of the BDCP in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- *CM18 Conservation Hatcheries*: This activity could result in the permanent removal of approximately 35 acres of terrestrial cover and aestivation habitat for California tiger salamander in the Yolo Bypass area (CZ 2). The specifications and operations of this facility have not been developed, although the facility is expected to be constructed near Rio Vista on cultivated lands in low-value habitat for the species.
- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions. Tidal habitat would be restored approximately 2 miles east of SR 113, with some restoration taking place along the Barker and Lindsey Slough channels west to approximately SR 113 and a small amount (0.4 acre) taking place along the Lindsey Slough Channel west of SR 113 into Critical Habitat Unit 2.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.
- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1-AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1C would permanently remove approximately 4 acres of aquatic habitat and 370 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 82 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

Typical NEPA project-level mitigation ratios of 1:1 for restored and 2:1 for protected nontidal wetlands (aquatic habitat) and a ratio of 2:1 for protected grassland habitats would indicate that 4 acres of aquatic habitat should be restored and 8 acres of aquatic habitat should be protected. In addition, 740 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes.

In addition, the plan contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander. Alternative 1C as a whole would result in the permanent loss of, and temporary effects on, 4 acres of aquatic habitat and 714 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

NEPA Effects: In the near-term, the loss of California tiger salamander habitat under Alternative 1C would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California tiger salamander upland habitat associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, the effects of Alternative 1C as a whole on California tiger salamander would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant.

Alternative 1C would permanently remove approximately 4 acres of aquatic habitat and 370 acres of upland terrestrial cover habitat for California tiger salamander. The effects would result from construction of the water conveyance facilities (CM1, 82 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

Typical CEQA project-level mitigation ratios of 1:1 for restored and 2:1 for protected nontidal wetlands (aquatic habitat) and a ratio of 2:1 for protected grassland habitats would indicate that 4 acres of aquatic habitat should be restored and 8 acres of aquatic habitat should be protected. In addition, 740 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation.

In addition, the plan contains commitments to implement AMM1–AMM6, AMM10, AMM13, and AMM37 which include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1C on California tiger salamander would be less than significant, because the number of acres required to meet the typical ratios described above would be only 740 acres of upland communities protected.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander. Alternative 1C as a whole would result in the permanent loss of, and temporary effects on, 4 acres of aquatic habitat and 714 acres of upland habitat for California tiger salamander for the term of the plan (less than 3% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3).Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

In the absence of other conservation actions, the losses of California tiger salamander upland habitat associated with Alternative 1C would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction phase, the impacts of Alternative 1C as a whole on California tiger salamander would be less than significant.

Impact BIO-47: Indirect Effects of Plan Implementation on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conservation component construction and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical night lighting at a worksite, over the term of the BDCP. Most of the areas indirectly affected are associated with the construction of Byron Forebay and its borrow and spoil areas in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

***NEPA Effects*:** Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 1C would avoid or minimize the potential for substantial adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on California tiger salamander.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances including aritifical night lighting at a worksite could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 1C, the BDCP would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 1C would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement is the only conservation measure expected to result in periodic inundation of California tiger salamander habitat. Periodic inundation of Yolo Bypass could affect from an estimated 191 acres of terrestrial habitat during a notch flow of 1,000 cfs, to an estimated 639 acres of terrestrial habitat during a notch flow of 4,000 cfs in CZ 1 (Table 12-1C-21). This effect would only occur during an estimated maximum of 30% of years and in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal terrestrial habitat for the California tiger salamander under Existing Conditions. No aquatic breeding habitat would be affected (Table 12-1C-21). The modeled habitat in the Yolo Bypass in the vicinity of terrestrial habitat is of low value in that there are no California tiger salamander records in this area and the bypass lacks vernal pool complexes with large, deep pools, or large grassland areas with stock ponds and similar aquatic features that provide the habitat of highest value for this species. Therefore, the terrestrial habitat to be affected has a small likelihood of supporting California tiger salamanders, and Yolo Bypass operations are expected to have a minimal effect on the species, if any.

NEPA Effects: The effects of periodic inundation from Alternative 1C would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Flooding of the Yolo Bypass from Fremont Weir operations would periodically increase the frequency and duration of inundation of 191–639 acres of terrestrial habitat for California tiger salamander. Because this area is considered low-value habitat and there are no California tiger salamander records in the area, and because of the lack of suitable breeding habitat in this area, the effects of periodic inundation of California tiger salamander habitat from Alternative 1C would have a less-than-significant impact**.**

Giant Garter Snake

The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic (except in Suisun Marsh), tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-1C-22. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP to benefit the giant garter snake (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3 and CM11).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Of the at least 1,200 acres of nontidal marsh created under (Objective NFEW/NPANC1.1), create 600 acres of aquatic habitat giant garter snake aquatic habitat that is connected to the 1,500 acres of rice land or equivalent-value habitat described below in Objective GGS1.4 (Objective GGS1.1, associated with CM3, CM4, and CM10).
- Of the 8,000 acres of grassland protected under Objective GNC1.1 and 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of nontidal perennial habitat being restored and/or created in CZ 4 and/or CZ 5 (Objective GGS1.2, associated with CM3 and CM8).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands (Objectives GGS1.1 and GGS1.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS1.3, associated with CM3).

- Create connections from the White Slough population to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 1,500 acres may consist of tidal freshwater emergent wetland and may overlap with the 24,000 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria described in CM4. Up to 500 (33%) of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS1.4, associated with CM3 and CM4).
- Of the at least 1,200 acres of nontidal marsh created under Objective NFEW/NPANC1.1, create 600 acres of connected aquatic giant garter snake habitat outside the Yolo Bypass in CZ 2 (Objective GGS2.1, associated with CM3 and CM10).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland habitat adjacent to the 600 acres of nontidal marsh created in CZ 2 outside of Yolo Bypass (GGS2.1) (Objective GGS2.2, associated with CM3 and CM8).
- To expand upon and buffer the newly restored/created nontidal perennial habitat in CZ 2, protect 700 acres of cultivated lands, with 500 acres consisting of rice land and the remainder consisting of compatible cultivated land that can support giant garter snakes. The cultivated lands may be a subset of lands protected for the cultivated lands natural community and other covered species (Objective GGS2.3, associated with CM3).
- Protect giant garter snakes on created nontidal marsh (Objective GGS2.1) and created or protected adjacent uplands (Objective GGS2.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads, and establishing giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS2.4, associated with CM3).
- Protect, restore, and/or create 2,740 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 1, CZ 2, CZ 4, or CZ 5. Up to 500 acres may consist of tidal freshwater emergent wetland and may overlap with the at least 5,000 acres of tidally restored freshwater emergent wetland in the Cache Slough ROA if this portion meets giant garter snake habitat criteria specified in CM4. Up to 1,700 acres may consist of rice fields in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*. Any remaining acreage will consist of rice land or equivalent-value habitat outside the Yolo Bypass. Up to 915 (33%) of the 2,740 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS3.1, associated with CM3, CM4, and CM10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-22. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 1C[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Aquatic (acres)	38	38	66	66	NA	NA
	Upland (acres)	203	203	473	473	NA	NA
	Aquatic (miles)	16	16	22	22	NA	NA
Total Impacts CM1 (acres)		**241**	**241**	**539**	**539**	**NA**	**NA**
CM2–CM18	Aquatic (acres)	179	498	15	38	NA	NA
	Upland (acres)	1,467	2,443	219	261	582–1,402	606
	Aquatic (miles)	49	189	9	10	NA	NA
Total Impacts CM2–CM18 (acres)		**1,646**	**2,941**	**234**	**299**	**582–1,402**	**606**
TOTAL IMPACTS CM1-CM18 (acres)		**1,887**	**3,182**	**773**	**838**	**582–1,402**	**606**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts on upland habitats only are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 1C conservation measures would result in the permanent and temporary loss combined of up to 640 acres of modeled aquatic habitat (tidal and nontidal combined), up to 3,380 acres of modeled upland habitat, and up to 237 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-1C-22). There are no giant garter snake occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal natural communities restoration (CM4), floodplain restoration (CM5), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent loss of approximately 241 acres of modeled giant garter snake habitat, composed of 38 acres of aquatic habitat and 203 acres of upland habitat (Table 12-1C-22). The 203 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 59 acres of high-, 125 acres of moderate-, and 19 acres of low-value habitat. In addition, approximately 16 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of 539 acres including 66 acres of giant garter snake aquatic habitat and up to 473 acres of adjacent upland habitat in areas near construction (see Table 12-1C-22 and Terrestrial Biology Map Book). In addition, approximately 22 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction.

  Most of the habitat that would be lost is located in the central Delta, in CZ 3 (Ryer Island), CZ 5 (Twitchell and Brannan Islands), CZ 6 (Bradford Island, Webb Tract, and Bethel Island), and CZ 8 and 9. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. The aquatic habitat in CZ 6 consists primarily of cultivated lands and associated irrigation ditches and is considered to have low to moderate potential for adverse effects on giant garter snake because it is not located near or between subpopulations identified in the draft recovery plan. Water facilities construction and operation is expected to have little to no adverse effect on giant garter snake aquatic habitat in the remaining CZs because it is not near or between subpopulations identified in the draft recovery plan.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 83 acres of aquatic habitat and 458 acres of upland habitat for the giant garter snake in the late long-term. The upland habitat that would be removed is composed of 336 acres of high-value, 121 acres of moderate-value, and 1 acre of low-value habitat. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Most of this habitat removal would occur at the north end of the Yolo Bypass, near Fremont Weir. Construction is expected to have adverse effects on giant garter snake aquatic habitat in the Yolo Bypass area because it is near the Yolo Basin/Willow Slough subpopulation.

  In addition to habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural community restoration would result in the permanent loss of approximately 395 acres of aquatic habitat and 2,123 acres of upland habitat for the giant garter snake to tidal marsh in the late long-term. The upland habitat affected by tidal inundation includes 594 acres of high-value, 1,375 acres of moderate-value, and 154 acres of low-value habitat. In addition, approximately 138 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration.

Most of the effects of tidal natural community restoration would occur in the Cache Slough and Yolo Bypass areas (CZ 1 and CZ 2). This aquatic habitat is of low to moderate value: it is in and near Category 1 open space but is not near any giant garter snake occurrences and is not near or between giant garter snake subpopulations identified in the draft recovery plan. Tidal natural communities restoration is expected to have little to no adverse effects on giant garter snake aquatic or upland habitat in the Cache Slough ROA. There are no giant garter snake occurrences in this area, which is already tidally influenced so it has limited value for the giant garter snake (giant garter snakes may occur in tidally muted areas but are not likely to use aquatic areas with a strong tidal influence).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 60 acres of aquatic and 89 acres of upland habitat for giant garter snake. The upland habitat to be removed is composed of 51 acres of moderate-value and 38 acres of low-value upland habitat. Approximately 2 miles of channels providing giant garter snake movement habitat would be removed as a result of floodplain restoration. Seasonally inundated floodplain restoration is expected to have little to no adverse effects on giant garter snake aquatic habitat because the site is not located near or between giant garter snake subpopulations identified in the draft recovery plan. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on giant garter snake habitat.*CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, AMM37 requires setbacks for trails in giant garter snake habitat (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*,). With this measure in place, recreation-related effects on giant garter snake are expected to be minimal.

- *CM18 Conservation Hatcheries*: Construction for conservation hatcheries could result in the permanent removal of 35 acres of moderate-value upland habitat for the giant garter snake in the Yolo Bypass area (CZ 2).

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the two subpopulations: Yolo Basin/Willow Slough [CZ 2] and the Coldani Marsh/White Slough [CZ 4 and 5]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1C would permanently and temporarily remove 298 acres of aquatic habitat and 2,362 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres of aquatic and 676 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 96 miles of channels (irrigation and drainage canals) providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 298 acres of aquatic habitat should be restored, 298 acres of aquatic habitat should be protected, and 4,724 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 298 acres of aquatic communities restored, 298 acres of aquatic communities protected, and 4,724 acres of upland communities protected.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities, AMM16 Giant Garter Snake, and AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 640 acres of aquatic habitat and to 3,380 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS 3.1would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11*)* would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations. BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

NEPA Effects: In the near-term, the loss of giant garter snake habitat under Alternative 1C would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of giant garter snake associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and AMM1–AMM7, AMM10, AMM16, and AMM37, the effects of Alternative 1C as a whole on giant garter snake would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 1C would permanently and temporarily remove 298 acres of aquatic habitat and 2,362 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres of aquatic and 676 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 96 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 298 acres of aquatic habitat should be restored, 298 acres of aquatic habitat should be protected, and 4,724 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees,

trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be not be adverse under CEQA, because the number of acres required to meet the typical ratios described above would be only 298 acres of aquatic communities restored, 298 acres of aquatic communities protected, and 4,724 acres of upland communities protected.

The Plan also includes commitments to implement AMM1–AMM7, AMM10, AMM16, and AMM37. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 640 acres of aquatic habitat and to 3,380 acres of upland habitat for giant garter snake during the term of the plan (2% of the total aquatic habitat and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS3.1 would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (*CM3 and CM11)* would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

The BDCP also includes AMM1–AMM7, AMM10, AMM16, and AMM37, which are directed at minimizing or avoiding potential impacts on adjacent habitats during construction and operation of the conservation measures. Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 1C as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of giant garter snake habitat and potential mortality of snakes would have a less-than-significant impact on giant garter snake under CEQA.

Impact BIO-50: Indirect Effects of Plan Implementation on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect throughout the plan's construction phase.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under CM1 were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and floodplains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with avoidance and minimization measures and adaptive management and monitoring, *CM12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities and floodplains.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the Central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Effects on giant garter snake from increased methylmercury exposures is more likely in the Yolo Basin, where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008). Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). Planned floodplain restoration activities in the Yolo Basin are expected to seasonally increase methylmercury production, although production would be minimized by *CM12 Methylmercury Mitigation*. Further, the periods of production and increased exposure to methylmercury do not overlap with giant garter snake seasonal activity periods. This seasonal trend should help to decrease risk to the giant garter snake, although snakes could prey on individuals that have been exposed to methylmercury during the previous season.

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *CM12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 is expected to reduce the effects of methylmercury resulting from BDCP natural communities and floodplain restoration on giant garter snake.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1C would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on giant garter snake.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37 as part of Alternative 1C construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Alternative 1C would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the indirect effects of Alternative 1C would have a less-than-significant impact on giant garter snakes. Giant garter snake could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes, and, therefore, would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 1C would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

NEPA Effects: Alternative 1C would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

CEQA Conclusion: Alternative 1C would have a less-than-significant impact on connectivity between giant garter snakes in the study area.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement: The proposed changes in Fremont Weir operations would occur intermittently from as early as mid-November through as late as mid-May. The core operations would occur during the winter/spring period, which corresponds mostly with the giant garter snake's inactive season. During this time, snakes are overwintering underground. Giant garter snakes that occur in the bypass during the active season could overwinter in the bypass during the inactive season: these snakes may be vulnerable to inundation of the bypass and could be drowned or displaced from overwintering sites. However, most typically, Fremont Weir "notch" operations would occur on the shoulders of time periods in which the Sacramento River raises enough for

Fremont Weir to overtop passively, without the proposed project. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Duration of inundation may also be an important factor determining effects on overwintering giant garter snakes. Radiotelemetry studies have revealed giant garter snakes surviving in burrows that had been inundated for 2 to 3 weeks, but it is unknown what duration of inundation the snakes can survive while overwintering in their burrows.

BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants,* provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect giant garter snakes overwintering in upland areas ranging from an estimated 582 acres of upland habitat during notch flow of 1,000 cfs to an estimated 1,402 acres during a 4,000-cfs notch flow. The 4,000-cfs notch flow would affect an estimated 888 acres of high value habitat and 514 acres of moderate value habitat.

As noted above under the discussion of habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of a maximum of 1,662 acres of rice fields (BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass*). This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term. Restoration and protection of 2,740 acres of rice land or habitat of equivalent value for the giant garter snake would achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 606 acres of upland habitat for the giant garter snake in the south Delta (CZ 7). The upland habitat to be inundated contains 432 acres of moderate-value and 174 acres of low-value habitat. The area between existing levees would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The restored floodplain will include a range of elevations from low-lying areas that flood frequently (e.g., every 1 to 2 years) to high-elevation areas that flood infrequently (e.g., every 10 years or more). There are no records of giant garter snakes in the vicinity of where floodplain restoration is expected to occur.

Based on modeled habitat for the giant garter snake, the study area supports approximately 53,285 acres of upland habitat for giant garter snake. Approximately 2,008 acres of giant garter snake upland habitat (4% of total upland habitat in the study area) may be adversely affected by periodic flooding as a consequence of floodplain restoration and the operation of the Fremont Weir.

NEPA Effects: Periodic effects on upland habitat for giant garter snake associated with implementing Alternative 1C are not expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, Alternative 1C would not adversely affect the species.

***CEQA Conclusion*:** Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect a total of approximately 2,008 acres of upland habitat for giant garter snake. The inundation could affect overwintering snakes. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that will be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Therefore, increased inundation in the Yolo Bypass as a result of BDCP is expected to have a minimal effect on the Yolo Basin/Willow Slough population.

Implementing Alternative 1C, including AMM1–AMM7, AMM10, and AMM16, would not be expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Periodic effects of inundation under Alternative 1C would have a less-than-significant impact on the species.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2A, Section 2A.30, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-1C-23. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP to benefit the western pond turtle (BDCP Chapter 3, *Conservation Strategy*).

- Protect or restore 142,200 acres of high-value natural communities and covered species habitats (Objective L1.1, associated with CM3).
- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise. Minimum restoration targets for tidal natural communities in each ROA are 7,000 acres in Suisun Marsh ROA, 5,000 acres in Cache Slough ROA, 1,500 acres in Cosumnes/Mokelumne ROA, 2,100 acres in West Delta ROA, and 5,000 acres in South Delta ROA (Objective L1.3, associated with CM2, CM3, and CM4).

- Within the 65,000 acres of tidal natural communities and transitional uplands (Objective L1.3), include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM3, CM4, and CM8).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Allow lateral river channel migration (Objective L2.2, associated with CM3 and CM5).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect and enhance 8,100 acres of managed wetland, 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3 and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-23. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 1C[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic (acres)	27	27	86	86	NA	NA
	Upland (acres)[e]	129	129	139	139	NA	NA
	Aquatic (miles)	17	17	24	24		
Total Impacts CM1 (acres)		**156**	**156**	**225**	**225**		
CM2–CM18	Aquatic (acres)	82	114	23	44	NA	NA
	Upland (acres)[e]	414	1,028	119	136	283–798	331
	Aquatic (miles)	25	109	3	4		
Total Impacts CM2–CM18 (acres)		**496**	**1,142**	**142**	**180**	**283–798**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**652**	**1,298**	**367**	**405**	**283–798**	**331**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

[e] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 1C conservation measures would result in the permanent and temporary loss of up to 271 acres of aquatic habitat and 1,432 acres of upland nesting and overwintering habitat (Table 12-1C-23). There are 4 western pond turtle occurrences that overlap with the CM1 footprint and a number of additional occurrences within the vicinity (Figure 12-16). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), seasonally inundated floodplain restoration (CM5), and riparian restoration (CM7). Habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western pond turtle habitat. The activity accounting for most (80%) of the habitat loss or conversion would be *CM4 Tidal Natural Communities Restoration* Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent loss of approximately 27 acres of aquatic habitat and 129 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-1C-23). Development of the water conveyance facilities would also result in the temporary removal of up to 86 acres of aquatic habitat and 139 acres of nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-1C-23). Approximately 17 miles of channels providing western pond turtle movement habitat would be removed and 24 miles would be temporarily disturbed. There are four western pond turtle occurrences that overlap with the CM1 footprint in CZ 2 around Clifton Court Forebay and in CZ 5 scattered throughout the Delta. The majority of the permanent loss of aquatic habitat and nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering and dispersal habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. While there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the canal footprint.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 60acres of aquatic habitat and 249 acres of upland nesting and overwintering habitat for the western pond turtle. Approximately 4 miles of channels providing western pond turtle movement habitat would be permanently or temporarily removed as a result of Yolo Bypass improvements. Although there are no CNDDB occurrences for western pond turtle in the Yolo Bypass, the species is known to be present in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2013).

- *CM4 Tidal Natural Communities Restoration*: Tidal natural community restoration would result in the conversion of approximately 45 acres of aquatic habitat and 872 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Approximately 106 miles of channels providing western pond turtle movement habitat would be removed as a result of restoration. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration outside Suisun Marsh is likely to create suitable, slow-moving freshwater slough and marsh habitat.

  Although the aquatic habitat model includes all tidal perennial aquatic, tidal brackish emergent wetland, and managed wetland as habitat, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not hydrologically connected to Suisun Marsh (Patterson pers. comm.). While the model does not include an aquatic class type called drainage ditches and therefore an effect on this habitat type cannot be calculated, it is likely that this general type of habitat accounts for a very small portion of the total modeled aquatic effects; almost certainly less than 5%, or less than 287 acres of the modeled aquatic habitat affected by tidal restoration. The suitable nesting and overwintering habitat that would be affected in the interior of Suisun Marsh is limited, because the levees likely function as the primary nesting and overwintering habitat. The nesting and overwintering habitat of highest value to be affected is on the fringe of the marsh where the aquatic habitat is adjacent to undeveloped grassland habitat.

The habitat affected in the interior Delta (West Delta and South Delta) is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle. Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration* Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 53 acres of aquatic habitat 33 acres of upland habitat for western pond turtle. Approximately 3 miles of channels providing western pond turtle movement habitat would be removed as a result of floodplain restoration. Although there are no CNDDB occurrences of the western pond turtle in the areas where floodplain restoration is likely to occur, the species is known to occur along the San Joaquin River to the south in the San Joaquin River National Wildlife Refuge. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration that is part of tidal natural communities restoration in CZ 1 and CZ 2, would result in the permanent removal of 10 acres of upland nesting and overwintering habitat for western pond turtle.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values over the term of the BDCP. In addition, effects would be avoided and minimized by the AMMs listed below.
- Management of the 6,600 acres of managed wetlands to be protected for waterfowl and shorebirds is not expected to result in overall adverse effects for the western pond turtle. Management actions that would improve wetland quality and diversity on managed wetlands include control and eradication of invasive plants; maintenance of a diversity of vegetation types and elevations, including upland areas to provide flood refugia; water management and leaching to reduce salinity; and enhancement of water management infrastructure (improvements to enhance drainage capacity, levee maintenance). These management actions could benefit the western pond turtle. The 6,600 acres of protected managed wetlands would be monitored and adaptively managed to ensure that management options are implemented to avoid adverse effects on the western pond turtle.
- Operations and maintenance: Ongoing maintenance of BDCP facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is

suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and conservation actions described below.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where conservation measures are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic and upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1C would permanently or temporarily remove 218 acres of aquatic habitat and 801 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 113 acres of aquatic and 268 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat), and riparian restoration (CM7, 4 acres of upland habitat).

Typical project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 218 acres of aquatic habitat should be restored, 218 acres of aquatic habitat should be protected, and 1,602 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation. Because the number of acres required to meet the typical ratios described above would be only 218 acres of aquatic communities protected, 218 acres restored, and 1,602 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1C on western pond turtles would not be adverse.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM17 Western Pond Turtle*. These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 1C would remove 271 acres of aquatic habitat and 1,432 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 1C as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, and MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species

(Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

NEPA Effects: In the near-term, the loss of western pond turtle habitat under Alternative 1C would not have an adverse effect because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of western pond turtle habitat associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, the effects of Alternative 1C as a whole on western pond turtle would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 1C would permanently or temporarily remove 218 acres of aquatic habitat and 801 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 113 acres of aquatic and 268 acres of upland habitat), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitat), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitat), and riparian restoration (CM7, 4 acres of upland habitat).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 218 acres of aquatic habitat should be restored, 218 acres of aquatic habitat should be protected, and 1,602 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, and Objective MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation for CEQA purposes. Because the number of acres required to meet the typical ratios described above would be only 218 acres of aquatic communities protected, 218 acres restored, and 1,602 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1C on western pond turtles would be less than significant.

In addition, the plan also contains commitments to implement AMM1–6, AMM10, and AMM17 which include elements that would avoid or minimize the risk of directly and indirectly affecting habitats and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 1C would remove 271 acres of aquatic habitat and 1,432 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 1C as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

The loss of western pond turtle habitat associated with Alternative 1C as a whole would represent an adverse effect as a result of special-status species habitat modification and the potential direct mortality of turtles. However, considering the habitat restoration and protection associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, which would be in place throughout the construction phase, the loss of habitat and potential mortality would not have an adverse effect on western pond turtle. Therefore, the loss of western pond turtle habitat and potential mortality of turtles resulting from Alternative 1C would have a less-than-significant impact on western pond turtle.

Impact BIO-53: Indirect Effects of Plan Implementation on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting, overwintering, and dispersal habitat for the western pond turtle. Construction activities outside of the construction footprint but within 200 feet of water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances over the term of the BDCP.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

Water operations would affect salinity gradients in Suisun Marsh. This effect mechanism cannot be disaggregated from tidal natural community restoration in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operation of salinity control gates to mimic a more natural water flow. Results of modeling for full implementation of the BDCP show salinity to double by the late long-term compared with current conditions during late fall and winter months. Changes in salinity would not be uniform across Suisun Marsh, as salinity would likely be more pronounced in some tidal channels and sloughs than others, and most of the salinity increase would occur during the fall and winter. Western pond turtles are primarily a freshwater species, although they can also be found in brackish marsh, and could respond negatively to increased salinity in Suisun Marsh. However, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not connected to tidal channels and sloughs in Suisun Marsh which is where increases in salinity would occur. Therefore, the potential effects associated with changes in salinity are not expected to adversely affect western pond turtles.

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 1C, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. Changes in water salinity would have a less-than-significant impact on western pond turtles because most of the salinity increases would occur in areas not used extensively by western pond turtles. With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 1C would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement would result in periodic inundation that could affect western pond turtle and its upland habitat. BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect from an estimated 283 acres of habitat during 1,000 cfs notch flow to an estimated 798 acres of habitat during 4,000 cfs notch flow (Table 12-1C-23). This effect would occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal overwintering habitat for the western pond turtle under Existing Conditions. Furthermore, Yolo Bypass inundation is not expected to affect nesting western pond turtles because operations would not occur during the nesting season (approximately May through October). Therefore, Yolo Bypass operations are expect to have a minimal effect, if any, on western pond turtles in the Yolo Bypass.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 331 acres of upland habitat for the western pond turtle in the south Delta (CZ 7). Seasonal flooding in restored floodplains is not expected to adversely affect aquatic and dispersal habitat, because these habitat functions are expected to remain in the seasonally inundated floodplains. Floodplains are not expected to be inundated during the nesting season, however, turtle hatchlings may overwinter in the nest and could be affected by flooding. Restored floodplains would transition for areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more); adverse effects on turtle hatchlings are most likely at the lower elevations of the restored floodplain, where frequent flooding occurs.

NEPA Effects: Periodic effects on upland habitat for western pond turtle from CM2 and CM5 associated with implementing Alternative 1C are not expected to result in substantial adverse effects either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Therefore, Alternative 1C would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect 283-798 acres from CM2 and approximately 331 acres from CM5 of upland habitat for western pond turtle. These acreages represent only 1% of the total upland western pond turtle habitat in the study area. Most of the increase in inundation would occur in the winter and early spring months, when western pond turtles may be in the water or overwintering and occupying upland habitats. Therefore, implementing Alternative 1C, including AMM1–AMM6, AMM10, and AMM17, would not be expected to result in substantial adverse effects on western pond turtle, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Periodic effects of inundation under Alternative 1C would have a less-than-significant impact on the species.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 1C on the silvery legless lizard, San Joaquin coachwhip and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10), which would not be affected by construction or restoration activities. This species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the whipsnake in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4) Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013). In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Alternative 1C is expected to result in the temporary and permanent removal of habitat that special-status reptiles uses for cover and dispersal (Table 12-1C-24). BDCP actions that could affect this habitat are limited to construction and maintenance of the water conveyance facilities in the vicinity of Clifton Court Forebay, and grassland restoration, protection and management. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP that would also benefit special-status reptiles (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-24. Changes in Special-Status Reptile Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	204	204	146	146	NA	NA
Total Impacts CM1		**204**	**204**	**146**	**146**	**NA**	**NA**
CM2–CM18	Grassland	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**204**	**204**	**146**	**146**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities. Impact acres represent the maximum reported for both species, however, there were 13 fewer acres of permanent habitat loss and 2 fewer acres of temporary habitat loss for the Blainville's horned lizard than for the coachwhip.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 1C conservation measures would result in the permanent and temporary loss of 350 acres of potential habitat for special-status reptiles in the study area (Table 12-1C-24). Water conveyance facilities and transmission line construction, including establishment and use of borrow and spoil areas, (CM1) would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effect are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though this would result in slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4 where it does not occur.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to conservation components could have similar affects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 204 acres of potential habitat for special-status reptiles in the vicinity of Clifton Court Forebay. Construction-related effects would temporarily disturb 146 acres of suitable habitat for special-status reptiles in the study area.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. *P. blainvillii* may only be active during the early morning and evening hours in the summer (Morey 2000). Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1C would remove 350 acres of grassland habitat for special-status reptiles in the study area. The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that up to 700 acres should be protected for both species in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, which would avoid and minimize injury or mortality of special-status reptiles during construction, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species from Alternative 1C would not be an adverse effect.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of up to 350 acres of special-status reptile habitat over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan Area. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects, specifically injury or mortality of special-status reptiles, would be addressed through implementation of Mitigation Measure BIO-55. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because Alternative 1C would result in a net increase in acreage of grassland habitat in the Plan Area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

NEPA Effects: In the near-term and late long-term, the loss of special-status reptile habitat under Alternative 1C would not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. However, injury or mortality of special-status reptiles as a result of Alternative 1C implementation would be an adverse effect. Mitigation Measure BIO-55 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA.

Alternative 1C would remove 350 acres of grassland habitat for special-status reptiles in the study area. The typical CEQA mitigation ratio (2:1 for protection) for this natural community would indicate that up to 700 acres should be protected for both species in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough to the timing of construction impacts to constitute mitigation for CEQA purposes. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, which would reduce the impact of injury or mortality of special-status reptiles, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species would be a less-than-significant impact.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of 350 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan area (Objective GNC1.1 and Objective GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Injury or mortality of special-status reptiles would be a significant impact that would be reduced through implementation of Mitigation Measure BIO-55.

The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would remove unsuitable special-status reptile habitat, such as cultivated land, and replace it with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because Alternative 1C would result in a net increase in acreage of grassland habitat in the study area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction. Considering the BDCP conservation strategy, the permanent and temporary loss of special-status reptile habitat under Alternative 1C would not result in a significant impact. Injury or mortality of special-status reptiles as a result of Alternative 1C implementation would have a significant impact on these species. Implementation of Mitigation Measure BIO-55 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support noncovered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work areas, the biologist will first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas with suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*, would be implemented for all noncovered special-status reptiles adversely affected by the BDCP to avoid, minimize, or compensate for impact.

Impact BIO-56: Indirect Effects of Plan Implementation on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat over the term of the BDCP. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of *AMM10 Restoration of Temporarily Affected Natural Communities*.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-55 would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 1C on special-status reptiles would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present. Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*, would reduce these impacts.

With implementation of Mitigation Measure BIO-55 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measures BIO-55, the indirect effects of Alternative 1C would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on the California black rail. The habitat model used to assess effects for the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta includes all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat includes all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones, providing refugia during high tides, within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and value foraging opportunities.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-1C-25. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the California black rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 1,700 acres of black rail habitat between restored tidal freshwater emergent wetlands and transitional uplands to provide upland refugia (Objective CBR1.1, associated with CM4).
- Create topographic heterogeneity in restored tidal brackish and freshwater emergent wetlands (Objectives TBEWNC1.4 and TFEWNC2.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and the implementation of AMM1–AMM7, AMM38 *California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-25. Changes in California Black Rail Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	5	5	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**5**	**5**	**NA**	**NA**
CM2–CM18	Primary	76	84	0	0	0	0
	Secondary	986	3,044	0	0	0	0
Total Impacts CM2–CM18		**1,062**	**3,128**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,062**	**3,128**	**5**	**5**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to permanent loss of and temporary effects on up to 89 acres of primary habitat and 3,044 acres of secondary habitat for California black rail (Table 12-1C-25). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1) and tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: There would be no permanent loss of California black rail habitat from the construction of the Alternative 1C conveyance facilities, however 5 acres of primary habitat would be temporarily impacted (Table 12-1C-25). This loss would be the result of canal siphon construction across Rock Slough near its junction with the Contra Costa Canal, and transmission corridor construction along the tunnel alignment in the west and south Delta (see the Terrestrial Mapbook for details of construction locations). The construction footprint for CM1 does not overlap with any California black rail occurrences. The implementation of *AMM38 California Black Rail* would minimize the effects of construction on adjacent rails if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Habitat loss from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction or channel modification from fish passage improvements associated with the Yolo Bypass would result in the permanent removal of approximately 5 acres of primary California black rail habitat in CZ 2. There are no occurrences of California black rail that intersect with the CM1 footprint. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be affected by tidal marsh restoration. Some California black rail modeled habitat would be permanently lost such that it no longer serves as habitat, while other modeled habitat would change value through conversion from one habitat type to another. Tidal habitat restoration site preparation and inundation would result in the permanent loss of 79 acres of primary habitat and 3,044 acres of secondary habitat for California black rail. Of the 79 acres of primary habitat lost, an estimated 76 acres would be converted to low marsh, or secondary habitat, for the species due to increased water elevations.

  The majority of the effects of tidal natural communities restoration would occur in Suisun Marsh (CZ 11). Much of the natural wetland habitat that would be removed occurs in isolated patches and would be replaced by larger continuous areas of tidal wetlands that are expected to support higher habitat functions for the rail than the impacted wetlands. As described in the BDCP, restoration of up to 24,000 acres of tidal freshwater emergent wetland in the Delta and at least 6,000 acres of tidal brackish emergent wetland natural communities in CZ 11 by the late long-term would benefit California black rail. The primary habitat for the species in the Delta consists of in channel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under CM4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration projects would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

  The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before the initiation of restoration actions in other areas. However, California black rails have a greater use of mature tidal marshes and, therefore, it would be years before the newly restored marshes provided suitable habitat for the species. In the long-term, tidal natural communities restoration is expected to have little to no adverse effects on California black rail habitat because the habitat removed would be replaced by a greater acreage of high-value tidal wetland and, thus, is expected to provide a benefit for California black rail.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions contained in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values over the term of the BDCP. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below. Additional actions under CM11 include the control of nonnative predators to reduce nest predation as needed.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the surrounding habitat in Suisun and the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California black rail. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction outside of the breeding season where feasible (reducing the risk of impacting active nests), construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of the species during construction, as required by AMM1–AMM7 and *AMM38 California Black Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1C implementation, there would be a loss of 1,067 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 5 acres of temporary loss of primary habitat), and implementing other conservation measures (CM2 Yolo Bypass Fisheries Enhancement and CM4 Tidal Natural Communities Restoration–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 5 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton

Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California black rail satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 89 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

NEPA Effects: The loss of California black rail habitat and potential direct mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by the biological objectives for the species and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*, which would be in place throughout the construction period, the effects of Alternative 1C as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1C implementation, there would be a loss of 1,067 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 5 acres of temporary loss of primary habitat), and implementing other conservation measures (CM2 Yolo Bypass Fisheries Enhancement and CM4 Tidal Natural Communities Restoration–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 5 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton

Marsh complex (Objective TBEWNC1.1) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Alternative 1C implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM38 California Black Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 3,608 acres of restored/created tidal natural communities, the 10,850 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for California black rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 89 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1).

Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California black rail.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of California black rail. A variety of rail species are known to suffer mortality from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al 1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Rayner 1988 and Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires. California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al 1994). However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would eliminate any potential for mortality of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for transmission lines constructed in the Delta to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. However, transmission facilities are expected to have few adverse effects on the black rail population. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines and select existing powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California black rail because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines and select existing powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Plan Implementation on California Black Rail

Indirect Construction-Related Effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in AMM38 that preconstruction surveys of potential breeding habitat would be conducted within 700 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure:

The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on Black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008); however, the majority of the overlap between restoration areas and black rail habitat is within Suisun Marsh, where conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Conservation Measure CM 12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California black rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California black rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*,). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California black rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California black rail would be minimized with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration actions that would create high and low tidal marsh, which is black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities and other conservation measures could disturb primary and secondary California black rail habitat adjacent to work sites. *AMM38 California Black Rail* would avoid and minimize impacts on California black rail from noise and visual disturbance. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species. These impacts on California black rail would be less than significant with the incorporation of AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is Black Rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and potentially temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *CM4 Tidal Natural Community Restoration* activities. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would not result in the periodic inundation of modeled habitat for California black rail. There are no records for California black rails in the Yolo Bypass, although the species is highly secretive and the extent to which the area has been surveyed for California black rails is unknown. Therefore, there is potential for the species to occur in the Yolo Bypass. In addition, rails may occur in the bypass after restoration activities are completed. However, periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in increased magnitude, frequency and duration of periodic inundation by up to 6 acres of modeled California black rail habitat in CZ 7. The risk of changes in inundation frequency, magnitude, and duration through implementation of CM2 and CM5 affecting California black rail are considered to be low, and would not be expected to result in adverse effects on the species.

NEPA Effects: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration through CM2 and CM5 implementation affecting California black rail is considered to be low.

CEQA Conclusion: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would represent a less-than-significant impact on California black rail because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration as a result of implementation of CM2 and CM5 affecting California black rail is considered to be low.

California Clapper Rail

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on California clapper rail. California clapper rail habitat includes mostly middle marsh habitat with select emergent wetland plant alliances. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and forage. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Covered Species Accounts*.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-1C-26. Full implementation of Alternative 1C would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-1C-26. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the California clapper rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and the implementation of AMM1–AMM7, *AMM19 California Clapper Rail*, and *AMM27 Selenium Management*, impacts on the California clapper rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-26. Changes to California Clapper Rail Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	26	27	0	0	0	0
	Secondary	50	50	0	0	0	0
Total Impacts CM2–CM18		**76**	**77**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**76**	**77**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

Alternative 1C conservation measures would result in the total loss or conversion of up to 35 acres of modeled clapper rail habitat consisting of 27 acres of primary habitat and 50 acres of secondary habitat (Table 12-1C-26). The conservation measure that would result in these losses is tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would convert approximately 77 acres of modeled California clapper rail habitat (27 acres of primary habitat, 50 acres of secondary habitat), the majority of which would occur in CZ 11. The tidal marsh restoration action would not result in the permanent loss of any California clapper rail habitat in the study area. However, approximately 27 acres of primary habitat would be converted to secondary low marsh habitat and 50 acres of secondary habitat would be converted to middle or high marsh. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11. Tidal wetlands would be restored as a mosaic of large, interconnected, and biologically diverse patches that supported a natural gradient extending from subtidal to the upland fringe. Much of the restored tidal brackish emergent wetland would meet the primary habitat requirements of the California clapper rail, including development of mid- and high-marsh vegetation with dense, tall stands of pickleweed cover. Restoration would be sequenced and spaced in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.

- *CM11 Natural Communities Enhancement and Management*: Because the entire California clapper rail population is restricted to the San Francisco Bay Area estuary, BDCP enhancement and restoration actions would be expected to benefit the species by creating the potential for extending its abundance and distribution in Suisun Marsh. Occupied California clapper rail habitat would be monitored to determine if there is a need for predator control actions. If implemented, nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats could result in localized ground disturbances that could temporarily remove small amounts of California clapper rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available California clapper rail habitat. These potential effects are currently not quantifiable, but would be minimized with implementation *AMM19, California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).
- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect California clapper rail use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, and habitat restoration, enhancement, and management could result in injury or mortality of California clapper rail. Operation of construction equipment could result in injury or mortality of California clapper rails. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is less likely as these individuals are expected to avoid contact with construction equipment. However, nest sites would be avoided during the nesting season as required by AMM1–AMM7 and *AMM19 California Clapper Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to compensate for the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4). These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 50 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and at least 1,500 acres of the restored marsh would consist of middle-and high-marsh vegetation, serving as primary habitat for California clapper rail in Suisun Marsh (Objectives TBEWNC1.1 and TBEWNC1.2). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, *Effects Analysis*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of California clapper rail habitat associated with Alternative 1C would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*, which would be in place throughout the construction period, the effects of Alternative 1C as a whole on California clapper rail would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term from the implementation of *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the study area. These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that

creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4).

These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of restoration impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM19 California Clapper Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 76 acres of restored tidal natural communities, the 2,000 acres of tidal brackish emergent wetland restoration contained in the near-term Plan goals, and the additional detail in the biological objectives for California clapper rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 8 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed, serving as primary habitat for clapper rail in Suisun Marsh (Objective TBEWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of California clapper rail. Therefore, the alternative would have a less-than-significant impact on California clapper rail.

Impact BIO-63: Indirect Effects of Plan Implementation on California Clapper Rail

Indirect Construction-Related Effects: California clapper rail habitat within the vicinity of proposed restoration areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California clapper rail. The use of mechanical equipment during construction-related restoration activities could cause the accidental release of petroleum or other contaminants that could affect clapper rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM19 California Clapper Rail* that preconstruction surveys of potential breeding habitat would be conducted within 500 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Preconstruction surveys conducted under *AMM19 California Clapper Rail and California Black Rail* would ensure construction-related noise and visual disturbances would not have an adverse effect on California clapper rail. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and ensure measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Therefore, with the implementation of AMM1–AMM7 and *AMM19 California Clapper Rail and California Black Rail*, there would be no adverse effect on California clapper rail.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which would be beneficial to California clapper rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rails are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on California clapper rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the California clapper rail. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California clapper rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California clapper rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California clapper rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. Potential

effects of noise and visual disturbances on California clapper rail would be minimized with *AMM19 California Clapper Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration Actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, changes in salinity, and increased exposure to selenium from Alternative 1C implementation would not have an adverse effect on California clapper rail.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities from the conservation measures could disturb California clapper rail habitat adjacent to work sites. *AMM19 California Clapper Rail* would avoid and minimize impacts on California clapper rail from noise and visual disturbance. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants or the inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. These impacts on California clapper rail would be less than significant with the incorporation of AMM1–AMM7 into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California clapper rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration Actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the study area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to 3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Appendix 5.J, Attachment5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to movements of California clapper rail. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and, thus, temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California clapper rail or restoration activities resulting in barriers to movement would be minimized through sequencing of restoration activities to minimize effects of temporary habitat loss. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California clapper rail as a result of special-status species habitat modification because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California clapper rail as a result of habitat modification of a special status species because Tidal Natural Communities Restoration (CM4) would be phased to allow for the recovery of some areas before initiating restoration actions in other areas. In addition, In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

California Least Tern

This section describe the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of California least tern modeled habitat as indicated in Table 12-1C-27. Full implementation of Alternative 1C also include the following conservation actions over the term of the BDCP to benefit California least tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect at least 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the at least 65,000 acres of tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation).

As explained below, with the restoration and protection of tidal perennial aquatic foraging habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and the implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-66, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-27. Changes in California Least Tern Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	25	25	117	117	NA	NA
Total Impacts CM1		**25**	**25**	**117**	**117**	**NA**	**NA**
CM2–CM18	Foraging	38	46	11	16	NA	NA
Total Impacts CM2–CM18		**38**	**46**	**11**	**16**	**NA**	**NA**
TOTAL IMPACTS		**63**	**71**	**128**	**133**	**NA**	**NA**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 204 acres of modeled foraging habitat for California least tern (Table 12-1C-27). The conservation measures that would result in these losses are construction of water conveyance facilities and operation (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 142 acres of modeled California least tern aquatic foraging habitat (Table 12-1C-27). Of the 142 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 117 acres would be a temporary loss. Most of the permanent loss would occur where Intakes 1-5 5 encroach on the Sacramento River's west bank between north of Clarksburg and Courtland. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, including in the Sacramento River at Intakes W1–5, and at temporary siphon, barge unloading and tunnel work areas along the western tunnel and canal alignment. The CM1 construction footprint would not overlap with any occurrences of California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized* (described below) would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on terns were they to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancement would result in the permanent loss of 8 acres and the temporary loss of 11 acres of modeled aquatic foraging habitat for California least tern in CZ 2. Activities from Fremont and Sacramento Weir improvements, Putah Creek realignment, and Lisbon Weir modification could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration actions would result in the permanent loss of 36 acres of modeled aquatic foraging habitat for California least tern. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic would be restored, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration is consistent with BDCP Objective TPANC1.1. Tidal perennial aquatic restoration would be expected to substantially increase the primary productivity of fish, increasing the prey base for California least tern. Approximately 3,400 acres of the restoration would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be phased over the following 30 years. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would result in the permanent loss of 2 acres and the temporary loss of 5 acres of modeled aquatic foraging habitat for California least tern. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers.

- *CM11 Natural Communities Enhancement and Management*: Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and injury mortality and noise and visual disturbance of nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic postconstruction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the BDCP. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in Suisun Marsh and west Delta area (CZ 10 and CZ 11). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or mortality would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 1C implementation, there would be a loss of 191 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 142 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 191 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3).This conservation action would result in the creation of approximately 3,400 acres of high quality tidal perennial aquatic natural community, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The California least tern is not a species that is covered under the BDCP. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies*, would be available to address this effect on nesting California least terns.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 204 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* would restore an estimated 27,000 acres of high quality tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

***NEPA Effects*:** The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1C would represent an adverse effect in the absence of other conservation actions. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this effect on nesting California least terns. With habitat restoration associated with CM4 and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*, which would be in place throughout the construction period, the effects of Alternative 1C as a whole on California least tern would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 1C implementation, there would be a loss of 191 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 142 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 191 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3). Modeling conducted by ESA PWA indicates that this conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would reduce the impact on nesting California least terns to a less-than-significant level.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, AMM1–AMM7 and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on*

Colonies will be Minimized, would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 191 acres of restored tidal perennial aquatic habitat, the 3,400 acres of tidal perennial aquatic restoration estimated in the near-term, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 204 acres of foraging habitat during the term of the Plan (less than 1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore an estimated 27,000 acres of high-value tidal perennial aquatic natural community (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

In the absence of other conservation actions, the loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1C would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 1C would represent a significant impact in the absence of other conservation actions.

However, with habitat restoration associated with CM4 and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, the loss of habitat or mortality under this alternative would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet of California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of Plan Implementation on California Least Tern

Indirect Construction- and Operation-Related Effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills from occurring or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and large mouth bass tissues were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in BDCP Appendix 5.D, *Contaminants*).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in

California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would be available to address this potential adverse effect. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-AMM7, AMM12, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of mortality of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would substantially reduce the potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on California least tern

Greater Sandhill Crane

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes "roosting and foraging" and "foraging" habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (BDCP Appendix 2A, *Covered Species Accounts*).

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-1C -28. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).
- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and the implementation of AMM1–AMM7, AMM20 *Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-28. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Roosting and Foraging - Permanent	0	0	0	0	NA	NA
	Roosting and Foraging - Temporary	0	0	1	1	NA	NA
	Foraging	1,445	1,445	2,259	2,259	NA	NA
Total Impacts CM1		**1,445**	**1,445**	**2,260**	**2,260**		
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	2,776	4,367	0	0	0	0
Total Impacts CM2–CM18		**2,776**	**4,408**	**0**	**0**	**0**	**0**
Roosting and Foraging - Permanent		**0**	**0**	**0**	**0**	**0**	**0**
Roosting and Foraging - Temporary		**0**	**41**	**1**	**1**	**0**	**0**
Total Foraging		**4,221**	**5,812**	**2,259**	**2,259**	**0**	**0**
TOTAL IMPACTS		**4,221**	**5,853**	**2,260**	**2,260**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 1C conservation measures would result in the temporary loss of up to 42 acres of temporary roosting and foraging habitat and 8,071 acres of foraging habitat for greater sandhill crane (5,812 acres of permanent loss, 2,259 acres of temporary loss, Table 12-1C-28). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas from *CM1 Water Facilities and Operation*, *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM10 Nontidal Marsh Restoration, and CM11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from conversion to tidal natural communities through CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities as they are currently designed would result in the combined permanent and temporary loss of up to 3,705 acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 1,445 acres of foraging habitat (Table 12-1C-28). Foraging habitat that would be permanently impacted by CM1 would consist of 525 acres of very high-value, 9 acres of high-value, and 541 acres of medium-value foraging habitat (Table 12-1C-29). In addition, 1 acre of temporary roosting and foraging habitat and 2,259 acres of foraging habitat would be temporarily affected due to construction. The temporarily removed foraging habitat would consist primarily of cultivated lands and it would be restored within one year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. Approximately half of the acres of foraging habitat that would be impacted would be a result of borrow and spoil areas associated with the construction of the intakes and the canal.

  The acre of temporary roosting and foraging habitat that would be temporarily impacted is located on Webb Tract, east of Bradford Island and the loss would be a result of the installation of a temporary transmission line along the southern border of the roost site. However, the implementation of *AMM20 Greater Sandhill Crane* would require that CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands. Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

  Approximately 617 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material on Brannan Island and northeast of Knightsen. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites. Conveyance construction impacts would primarily occur west of the highest crane use areas in the central Delta. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1C-29. Total Amount of Affected Greater Sandhill Crane Foraging Habitat

Foraging Habitat Value Class	Land Cover Type	Acres Affected by CM1 permanent (temporary)	Acres Affected by CM2–CM18 permanent (temporary)
Very high	Corn, rice	525 (350)	1,155 (0)
High	Wheat, managed wetlands,	9 (53)	489 (0)
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	541 (836)	1,403 (0)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	370(1,020)	1,320 (0)
Total		1,445 (2,259)	4,367 (0)

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 2,754 acres of greater sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 2,713 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 716 acres of very high-value, 304 acres of high-value, 873 acres of medium-value, and 821 acres of low-value foraging habitat This loss would occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. In CZ 5, loss of modeled habitat would occur along the western edge of the greater sandhill crane winter use area and therefore would not result in fragmentation of traditional crane habitats. Therefore fragmentation of habitat from tidal restoration activities would be expected to be minimal. Approximately 1,951 acres of foraging habitat would be impacted within the first 10 years of Alternative 1C implementation.
- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands that provide foraging habitat for greater sandhill crane would be converted to grassland by the late long-term timeframe. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the greater sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Plan implementation.
- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the greater sandhill

crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 1C implementation.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, greater sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of plan implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential effects would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. The potential for injury and direct mortality from electrical transmission facilities is discussed below under Impact BIO-70.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 1 acre of roosting and foraging habitat in the study area in the near-term as a result of the construction of the water conveyance facilities (CM1). In addition, 6,480 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,704 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 4,248 acres would be moderate- to very high-value habitat (CM1, 2,313 acres, CM4-11, 1,935 acres). Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 1 acres of greater roosting habitat should be restored/created and 1 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 2,313 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,927 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on the acre of roosting and foraging habitat once the project design was final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to construction. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a, *Compensate for the Loss of Medium- to Very High-Value Greater Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 42 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 8,071 acres of foraging habitat (5% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 5,360 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering habitat protection, restoration, management, and enhancement would be guided by performance standards, and the aforementioned AMMs, which would be in place throughout the period of construction, greater sandhill crane habitat losses and conversions under Alternative 1C would not be an adverse effect under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 1 acre of roosting and foraging habitat in the study area in the near-term as a result of the construction of the water conveyance facilities (CM1). In addition, 6,480 acres of foraging habitat would be removed or converted in the near-term (CM1, 3,704 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 4,248 acres would be moderate- to very high-value habitat (CM1, 2,313 acres, CM4-11, 1,935 acres). Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 1 acres of greater roosting habitat should be restored/created and 1 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 2,313 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on the acre of roosting and foraging habitat once the project design was final. Methods to avoid direct impacts on crane roost sites are described in *AMM20 Greater Sandhill Crane*.

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Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to construction. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

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The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with

consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 1C would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Considering Alternative 1C's protection and restoration provisions, in addition to Mitigation Measure BIO-69a, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1 prior to or concurrent with impacts, loss of habitat and direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on greater sandhill crane.

Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat

DWR will compensate for the loss of greater sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent within the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging habitat value categories are listed in Table 12-1C-29. Foraging habitat conservation must occur within the greater sandhill crane winter use area and the location of protected habitat or conservation easements must be preapproved by USFWS and CDFW.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 1C facilities as described below. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1C was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Typically, higher-voltage (230-kilovolt [kV]) lines vary in height from 90 to 110 feet, while “sub” transmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1C alignment would require the installation of approximately 36 miles of permanent transmission line (18 miles of 230-kV lines and 18 miles of 69-kV lines) extending north and south, to the west of the high-use crane areas. The temporary transmission lines would total approximately 71 miles (14 miles of 69-kV line and 57 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1C meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed for the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing mortality in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1C is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1C would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1C is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* andone or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1C would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of Plan Implementation on Greater Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 1C and to determine that as much as 3,186-10,204 acres of crane foraging habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). In addition, 1,720 – 7,382 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60 dBA, Table 12-1C-30). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-1C-30. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 1C (acres)

	General Construction		Pile Driving	
Habitat Type	Above 60 dBA	Above 50 dBA	Above 60 dBA	Above 50 dBA
Permanent Roosting	0	0	0	0
Temporary Roosting	0	0	0	0
Foraging	3,186	10,204	1,720	7,382
Total Habitat	**3,186**	**10,204**	**1,720**	**7,382**

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on greater sandhill crane. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Therefore, potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect greater sandhill crane via uptake in lower trophic levels (see Appendix 5.D, *Contaminants*, of the BDCP). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Crane foraging habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators.

Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in greater sandhill cranes would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1C would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on greater sandhill crane.

Lesser Sandhill Crane

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. These habitat types include suitable foraging and roosting habitat in the study area as certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser Sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-1C-31. Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP for the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*) that would also benefit the lesser sandhill crane.

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).
- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).
- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).

- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and the implementation of AMM1–AMM7, AMM20 *Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-31. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Roosting and Foraging - Permanent	0	0	0	0	NA	NA
	Roosting and Foraging - Temporary	0	0	1	1	NA	NA
	Foraging	3,639	3,639	5,679	5,679	NA	NA
Total Impacts CM1		**3,639**	**3,639**	**5,680**	**5,680**		
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	3,610	12,131	2	4	0	0
Total Impacts CM2–CM18		**3,610**	**12,172**	**2**	**4**	**0**	**0**
Total Roosting and Foraging - Permanent		**0**	**0**	**0**	**0**	**0**	**0**
Total Roosting and Foraging - Temporary		**0**	**41**	**1**	**1**	**0**	**0**
Total Foraging		**7,249**	**15,770**	**5,681**	**5,683**		
TOTAL IMPACTS		**7,249**	**15,811**	**5,682**	**5,684**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 1C conservation measures would not impact lesser sandhill crane roosting habitat. However, they would result in the temporary loss of up to 1 acre of modeled roosting and foraging habitat and 21,453 acres of foraging habitat (15,770 acres of permanent loss and 5,681 acres of temporary loss) for lesser sandhill crane (Table 12-1C-31). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Improvements (CM2), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities as they are currently designed would result in the combined permanent and temporary loss of up to 9,318 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 3,639 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 1,467 acres of very high-value, 502 acres of high-value, and 882 acres of medium-value foraging habitat (Table 12-1C-32). In addition, 1 acre of temporary roosting and foraging habitat and 5,679 acres of foraging habitat would be temporarily removed (Table 12-1C-31). The temporarily removed foraging habitat would consist primarily of cultivated lands and it would be restored within one year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. Approximately half of the acres of foraging habitat that would be impacted would be a result of borrow and spoil areas associated with the construction of the intakes and the canal.

  The acre of temporary roosting and foraging habitat that would be temporarily impacted is located on Webb Tract, east of Bradford Island and the loss would be a result of the installation of a temporary transmission line along the southern border of the roost site. However, the implementation of *AMM20 Greater Sandhill Crane* would require that CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands. Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*,). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

  Approximately 617 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material on Brannan Island and northeast of Knightsen. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. The actual footprint of the storage areas required for reusable tunnel material is flexible, and the actual acreage of habitat affected by this activity could be reduced based on the height of the storage piles in addition to other considerations. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites. Conveyance construction impacts would primarily occur west of the highest crane use areas in the central Delta. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Plan implementation.

Table 12-1C-32. Total Amount of Affected Lesser Sandhill Crane Foraging Habitat

Foraging Habitat Value Class	Land Cover Type	CM1 Permanent (Temporary)	CM2-CM18 Permanent (Temporary)
Very high	Corn, alfalfa and alfalfa mixtures	1,467 (2,143)	4,083 (0)
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	502 (687)	2,058 (0)
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, non-irrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	882 (1,039)	2,220 (2)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	788 (1,810)	3,745 (2)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction under CM2 would result in a permanent loss of 267 acres and a temporary loss of 2 acres of lesser sandhill crane foraging habitat in CZ 2. Lesser sandhill crane use in this area is less common than in the central Delta. Construction impacts from CM2 would occur within the first 10 years of Plan implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 10,248 acres of lesser sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 10,207 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 3,642 acres of very high-value, 1,529 acres of high value, 2,040 acres of medium-value, and 2,983 acres of low-value foraging habitat (Table 12-1C-32). Habitat loss would primarily occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. Lesser sandhill cranes are less traditional than greater sandhill cranes and would be more adaptable to changes in land use. Approximately 2,516 acres of foraging habitat would be removed within the first 10 years of Plan implementation.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees would result in the loss of 2 acres of low-value lesser sandhill crane foraging habitat (1 acre of permanent loss, 1 acres of temporary loss). This impact would occur after the first 10 years of Plan implementation.

- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands (foraging habitat) would be converted to grassland. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the lesser sandhill crane. Approximately 257 acres would be impacted within the first 10 years of plan implementation.

- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the lesser sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Plan implementation.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of plan implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential effects would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. Injury and mortality from electrical transmission facilities are described below under Impact BIO-73.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, the Plan would remove 1 acre of roosting and foraging habitat in the study area in the near-term as a result of the construction of the water conveyance facilities (CM1). In addition, 12,931 acres of foraging habitat would be removed or converted in the near-term (CM1, 9,318 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 9,226 acres would be medium- to very high-value habitat (CM1, 6,720 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 1 acre of lesser sandhill crane roosting habitat should be restored/created and 1 acre should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 6,720 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on the acre of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72, *Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 42 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 21,453 acres of foraging habitat (9% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 15,083 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no crane roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater sandhill crane (Objective GSHC1.1). These croptypes would also provide high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat and potential for direct mortality of this special status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration*, guided by biological goals and objectives for the species and by AMM1–AMM7*, AMM20 Greater Sandhill Crane*, which would be in place throughout the construction period, and Mitigation Measure BIO-72, which would be available to compensate for loss of medium- to very high-value foraging habitat, the effects of habitat loss and potential mortality on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, the Plan would remove 1 acre of roosting and foraging habitat in the study area in the near-term as a result of the construction of the water conveyance facilities (CM1). In addition, 12,931 acres of foraging habitat would be removed or converted in the near-term (CM1, 9,318 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 9,226 acres would be medium- to very high-value habitat (CM1, 6,720 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 1 acre of lesser sandhill crane roosting habitat should be restored/created and 1 acre should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 6,720 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on the acre of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

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The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

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At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72, *Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

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The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater sandhill crane (Objective GSHC1.1). These croptypes would also provide high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with

consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1C's protection and restoration provisions, in addition to Mitigation Measure BIO-72, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on lesser sandhill crane.

Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

DWR must compensate for the loss of lesser sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging value categories are listed in Table 12-1C-32. Foraging habitat conservation must occur within 10 kilometers of traditional sandhill crane roost sites and the location of protected habitat or conservation easements must be preapproved by CDFW.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to BDCP facilities. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 1C was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

Typically, higher-voltage (230-kilovolt [kV]) lines vary in height from 90 to 110 feet, while "sub" transmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 1C alignment would require the installation of approximately 36 miles of permanent transmission line (18 miles of 230-kV lines and 18 miles of 69-kV lines) extending north and south, to the west of the high-use crane areas. The temporary transmission lines would total approximately 71 miles (14 miles of 69-kV line and 57 miles of 12-kV line). Temporary lines would be removed after construction of the water conveyance facilities, within 10 years.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 1C meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes National Wildlife Refuge project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for lesser sandhill crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed for the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Effects: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1C is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoided crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit the lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1C would not result in an adverse effect on lesser sandhill crane.

***CEQA Conclusion*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 1C is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 1C would would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of Plan Implementation on Lesser Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 1C and to determine that as much as 3,186-10,204 acres of crane foraging habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). In addition, 1,720 – 7,382 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-1C-30 under Impact-BIO-71). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on lesser sandhill crane as they primarily forage on cultivated crops and invertebrates. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect lesser sandhill crane via uptake in lower trophic levels (see BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Crane foraging habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Crane foraging habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators.

Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat, there would not be an adverse effect on lesser sandhill crane.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of A*MM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in lesser sandhill crane would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on lesser sandhill crane.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 1C would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on the least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-1C-33. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit least Bell's vireo and yellow warbler (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM7).
- Maintain and enhance structural heterogeneity (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation (Objective VFRNC2.2, associated with CM7).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and the implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-33. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Migratory and Breeding	14	14	44	44	NA	NA
Total Impacts CM1		**14**	**14**	**44**	**44**	**NA**	**NA**
CM2–CM18	Migratory and Breeding	382	656	88	109	48–85	148
Total Impacts CM2–CM18		**382**	**656**	**88**	**109**	**48–85**	**148**
TOTAL IMPACTS		**396**	**670**	**132**	**153**	**48–85**	**148**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 823 acres of modeled habitat (670 acres of permanent loss and 153 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-1C-33). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 58 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-1C-33). Of the 58 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 14 acres would be a permanent loss and 44 acres would be a temporary loss of habitat. Almost all of the losses would occur on the narrow borders of waterways that are crossed by water conveyance facilities. In the north Delta, most of the permanent loss would be where Intakes 1–5 encroach on the Sacramento River's west bank from just north of Clarksburg to just north of Courtland. The riparian areas here are very small patches, some dominated by valley oak and willows, and others by nonnative trees and mixed brambles (see Terrestrial Biology Mapbook). Other small patches or narrow bands of riparian vegetation dominated by valley oak and willow would be permanently removed by canal construction and borrow areas in the vicinity of Elk Slough south of Clarksburg. A long band of mixed brambles and willows would be lost adjacent to the Sacramento River Deep Water Ship Channel, north of Miner Slough. The temporary losses of valley/foothill riparian natural community would be associated with temporary canal and siphon work areas where the canal would cross Elk Slough on the west side of Merritt Island, Duck Slough west of Courtland, Miner Slough on the northwest corner of Ryer Island, and Kellogg Creek southwest of Discovery Bay. The vegetation in these areas ranges from small stands of valley oak and willow to narrow bands of alder and mixed brambles. Small temporary losses associated with transmission line construction would occur along the entire canal/pipeline route.

  Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least four years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancements would permanently remove approximately 83 acres and temporarily remove 88 acres of modeled least Bell's vireo and yellow warbler habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled least Bell's vireo and yellow warbler habitat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 28 acres and temporarily remove 21 acres of modeled least Bell's vireo and yellow warbler habitat. Based on the riparian habitat restoration assumptions, a minimum of 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions.

The actual number of acres of valley/foothill riparian habitat that CM4 and CM5 would restore may differ from these estimates, depending on how closely the actual outcome of tidal habitat restoration approximates the assumed outcome. However, riparian restoration from CM4 and CM5 would increase the extent of least Bell's vireo and yellow warbler habitat within the study area once the restored riparian vegetation has developed habitat functions for these species.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat over the term of the BDCP. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the study area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the study area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Although least Bell's vireo nesting has not been confirmed in the study area, recent occurrences in the Yolo Bypass and at the San Joaquin River National Wildlife Refuge suggest that the reestablishment of a breeding population is a possibility over the duration of the BDCP. If present in the study area, construction -related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If

either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 528 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal habitat restoration [CM4], seasonally inundated floodplain restoration [CM5]— 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 58 acres of valley/foothill riparian habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests were detected and avoided. Mitigation Measure BIO-75 would be available to address adverse effects on nesting yellow warblers.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 823 acres of habitat for these species during the term of the Plan (6% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo, and the effect of habitat loss on yellow warbler under Alternative 1C would not be adverse. The yellow warbler is not a species that is covered under the BDCP and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Alternative 1C would remove 528 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal habitat restoration [CM4], seasonally inundated floodplain restoration [CM5]— 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 58 acres of valley/foothill riparian habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require

470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the Plan Area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting yellow warblers to a less-than-significant impact, should they become established in the Plan Area. Considering the conservation actions described above, and AMM1-–AMM7, AMM 22, and Mitigation Measure BIO-75, Alternative 1C, over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 1C would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 823 acres of habitat for these species during the term of the Plan (6% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Therefore, there would be a time-lag before the restored habitat would benefit either species. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo under Alternative 1C would be less than significant. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect nesting yellow warblers, in order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting yellow warblers, if present in the study area, to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.
- A qualified wildlife biologists with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors and species of special concern (except the Modesto song sparrow), and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.
- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of implementing Alternative 1C would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 1C would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*, of the BDCP). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that the transmission lines, poles, and towers are designed to avoid sensitive terrestrial habitats (including riparian) to the maximum extent feasible, which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which will minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of Plan Implementation on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least Bell's vireo and yellow warbler.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least Bell's vireo and yellow warbler from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting yellow warblers.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential effects of methylmercury on least Bell's vireo and yellow warbler.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on least Bell's vireo and yellow warbler with the implementation of *AMM2 Construction Best Management Practices and Monitoring*, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Sites-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential significant impacts on least Bell's vireo and yellow warbler.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-85 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 2. No adverse effects of increased inundation frequency on least Bell's vireo, yellow warbler, or their habitat would be expected, because riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in periodic inundation of up to 148 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 7. Inundation of restored floodplains would not be expected to affect least Bell's vireo, yellow warbler, or their habitat because the breeding period is outside the period when floodplains would likely be inundated. Additionally, periodic inundation of floodplains would be expected to restore a more natural flood regime in support of riparian vegetation types that support least Bell's vireo and yellow warbler habitat. The overall effect of seasonal inundation in existing riparian natural communities would be beneficial, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would not result in an adverse effect on least Bell's vireo or yellow warbler because inundation would occur primarily during the nonbreeding season and would promote a more natural flood regime in support of habitat for these species.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would have a less-than-significant impact on least Bell's vireo or yellow warbler because inundation would occur during the nonbreeding season and would not be expected to adversely modify habitat or result in direct mortality of either species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation in existing riparian natural communities would be beneficial for least Bell's vireo and yellow warbler.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 1C on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects for Suisun song sparrow and saltmarsh common yellowthroat is based on primary breeding habitat and secondary habitat. Suisun song sparrow primary breeding habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the Plan Area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable forage. Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-1C-34. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of

Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the Suisun song sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3)
- Protect at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3)

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and the implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on Suisun song sparrow and saltmarsh common yellowthroat would not be adverse for NEPA purposes and would be less than significant for CEQA. purposes.

Table 12-1C-34. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	54	55	0	0	0	0
	Secondary	1,098	3,633	0	0	0	0
Total Impacts CM2–CM18		**1,152**	**3,688**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,152**	**3,688**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Alternative 1C conservation measures would result in the permanent loss of up to 3,510 acres of modeled secondary habitat, the conversion of 55 acres of primary habitat to secondary low marsh, and the conversion of 123 acres of secondary habitat to middle or high marsh (for a total impact of 55 acres primary habitat and 3,633 acres of secondary habitat, Table 12-1C-34). The only conservation measure that would affect modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would permanently remove approximately 3,510 acres of modeled secondary Suisun song sparrow and saltmarsh common yellowthroat habitat from CZ 11 (Table 12-1C-34). In addition, 55 acres of primary habitat would be converted to secondary low marsh, and 123 acres of secondary habitat would be converted to middle or high marsh. Most areas proposed for removal would be managed wetlands that serve as relatively marginal habitat for Suisun song sparrow and saltmarsh common yellowthroat, which primarily use brackish tidal wetlands. Approximately 2% of primary habitat for these species would be converted to foraging habitat. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland natural community in CZ 11, which would be expected to support Suisun song sparrow and saltmarsh common yellowthroat habitat. It is expected that restoring tidal wetland communities that are self-sustaining and not reliant on ongoing management actions necessary to maintain the existing managed wetland habitats would better ensure the long-term viability of these populations. Furthermore, effects of tidal habitat restoration on sparrow and yellowthroat abundance and distribution would be monitored, and the restoration of tidal habitat would be sequenced and located in a manner that minimizes effects on occupied habitats until functional habitats were restored (see BDCP Chapter 3, Section 3.4.4, *Conservation Measure 4 Tidal Natural Communities Restoration*, and Section 3.6, *Adaptive Management and Monitoring Program*).

- *CM11 Natural Communities Enhancement and Management:* Control of nonnative Suisun song sparrow and saltmarsh common yellowthroat predators, if deemed necessary, would be expected to reduce predation loss of nests and, consequently, increase and maintain the abundance of Suisun song sparrow and saltmarsh common yellowthroat in restored tidal habitats over the term of the BDCP. Habitat management- and enhancement-related activities could disturb Suisun song sparrow or saltmarsh common yellowthroat nests if they are located near work sites. The potential for these activities to have an adverse effect on Suisun song sparrow would be avoided and minimized through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. A variety of CM11 habitat management actions that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of Suisun song sparrow and saltmarsh common yellowthroat habitat in CZ 11. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available species' habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect Suisun song sparrow and saltmarsh common yellowthroat use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Construction-related activities could result in nest destruction or disturbance resulting in mortality of eggs and nestlings if restoration activities took place within the nesting period for these species. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize these potential effects on Suisun song sparrow. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. Grading, filling, contouring, and other initial ground-disturbing operations during restoration activities could temporarily fragment existing modeled tidal brackish emergent wetland habitat for Suisun song sparrow and saltmarsh common yellowthroat which could temporarily reduce the extent and functions of the affected habitat. These temporary effects would be minimized through sequencing of restoration activities and through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing CM4 tidal restoration in CZ 11. The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 permanent losses of Suisun song sparrow and saltmarsh common yellowthroat habitat in the near-term.

The BDCP has committed to near-term goals of restoring 1,000 acres of tidal brackish emergent wetlands in the study area. Although this 1,000 acres is slightly less than the 1:1 restoration ratio, the secondary habitat that would be permanently lost would be primarily lower value managed wetlands, and this would be replaced with higher value tidal brackish marsh foraging habitat. These conservation actions would occur in the same timeframe as the early restoration losses. To ensure that this natural community conservation benefits the species, the Plan's biological goals and objectives (BDCP Chapter 3, Section 3.3) further specify that within the 6,000 acres of tidal brackish emergent marsh restored in the late long-term, at least 1,500 acres would be restored as high and mid marsh, providing primary habitat for these species. In addition, of the 8,000 acres of protected and 2,000 acres of restored grassland, in the late long-term, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, benefitting both species. These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun Marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration contained in the near-term Plan goals with the management and enhancement actions (CM11), and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3, Section 3.3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Yellow-Billed Cuckoo*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 3,761 acres of primary and 23,997 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1C as a whole would result in the permanent loss of 3,510 acres of secondary habitat (15% of the total secondary habitat in the study area). In addition, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat. The Plan includes a commitment to restore or create at least 3,000 acres of tidal brackish emergent wetlands in Suisun Marsh in CZ 11 (Table 12-1C-34). The secondary habitat that would be permanently lost would be primarily lower value managed wetlands, and this would be replaced with higher value tidal brackish marsh foraging habitat. These conservation actions would occur in the same timeframe as the early restoration losses. To ensure that this natural community conservation benefits the species, the Plan's biological goals and objectives (BDCP Chapter 3, Section 3.3) further specify that within the 3,000 acres of tidal brackish emergent marsh restored in the late long-term, at least 1,500 acres would be restored as high and mid marsh, providing primary habitat for these species. In addition, of the 8,000 acres of protected and 2,000 acres of restored grassland, in the late long-term, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, benefitting both species. These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The loss of secondary habitat associated with Alternative 1C would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and with the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3, Section 3.3), guided by AMM1–AMM7, and AMM22, which would be in place throughout the construction phase, the effects of habitat loss and conversion on Suisun song sparrow would not be adverse under Alternative 1C. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided.

NEPA Effects: The loss of Suisun song sparrow and saltmarsh common yellowthroat habitat and potential direct mortality of these special status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and with the incorporation of the additional measures in the biological goals and objectives, AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on Suisun song sparrow, and the effects of habitat loss on saltmarsh common yellowthroat would not be adverse under Alternative 1C. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order for the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

CEQA Conclusion: Alternative 1C (CM4) would have permanent impacts on Suisun song sparrow and saltmarsh common yellowthroat and their modeled habitat, and the operation of construction equipment could injure or disturb individuals.

Near-Term Timeframe

There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing CM4 tidal restoration in CZ 11. Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM4 and that are identified in the biological goals and objectives in

Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using these typical ratios would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 permanent losses of Suisun song sparrow and saltmarsh common yellowthroat habitat in the near-term.

The BDCP has committed to near-term goals of restoring 1,000 acres of tidal brackish emergent wetlands in the study area in CZ 11. Although this 1,000 acres is slightly less than the 1:1 restoration ratio, the secondary habitat that would be permanently lost would be primarily lower value managed wetlands, and this would be replaced with higher value tidal brackish marsh foraging habitat. These conservation actions would occur in the same timeframe as the early restoration losses. To ensure that this natural community conservation benefits the species, the Plan's biological goals and objectives (BDCP Chapter 3, Section 3.3) further specify that within the 3,000 acres of tidal brackish emergent marsh restored in the late long-term, at least 1,500 acres would be restored as high and mid marsh, providing primary habitat for these species. In addition, of the 8,000 acres of protected and 2,000 acres of restored grassland, in the late long-term, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, benefitting both species. These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun Marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration contained in the near-term Plan goals with the management and enhancement actions (CM11), and the incorporation of the additional measures in the biological goals and objectives would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness, AMM2 Construction Best Management Practices and Monitoring, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operation Plan and AMM22 Suisun Song Sparrow, Yellow-breasted Chat, Least Bell's Vireo, Yellow-Billed Cuckoo*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow may also detect nesting saltmarsh common yellowthroat, in order to have a less-than-significant effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the potential impact on nesting saltmarsh common yellowthroat to a less-than-significant impact.

The 1,000 acres of restoration contained in the near-term Plan goals, the additional direction in the biological goals and objectives, and management and enhancement activities in CM11, would be sufficient to support the conclusion that the near-term effects of habitat loss and direct mortality under Alternative 1C would be less than significant under CEQA, as AMM1–AMM7, AMM22, and

Mitigation Measure BIO-75 would avoid and minimize potential impacts on the species from construction-related habitat loss.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 1C as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a covered species under the BDCP. Although preconstruction surveys for Suisun song sparrow may detect nesting saltmarsh common yellowthroat, for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting saltmarsh common yellowthroat to a less-than-significant level.

Considering these restoration provisions, which would replace low-value secondary habitat with high-value tidal brackish emergent habitat, including both foraging and primary habitat, and provide upland refugia for Suisun song sparrow and saltmarsh common yellowthroat, the acreages of restoration would be sufficient to compensate for habitats lost to construction and restoration activities. Loss of habitat or direct mortality through implementation of Alternative 1C, with the implementation of AMM1–AMM7, AMM22, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-81: Indirect Effects of Plan Implementation on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Indirect Construction-Related Effects: If Suisun song sparrow or saltmarsh common yellowthroat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Suisun song sparrow and saltmarsh common yellowthroat habitat adjacent to restoration work areas could be affected by such disturbances, which could temporarily result in diminished use of habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect either species. If construction occurred during the nesting season, these indirect effects could result in the loss or abandonment of nests and mortality of any eggs and/or nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of Suisun song sparrow and saltmarsh common yellowthroat by requiring preconstruction surveys and, if nests are present, the establishment of a no-disturbance buffer within 250 feet of a nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Salinity: Water conveyance facilities operations would have an effect on salinity gradients in Suisun Marsh; however, these effects cannot be reasonably disaggregated from effects resulting from tidal habitat restoration. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water conveyance facilities operations and operations of salinity control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more saline environments, which should have a beneficial effect on Suisun song sparrow and saltmarsh common yellowthroat because their historical natural Suisun Marsh habitat is brackish tidal marsh. However, the degree to which salinity changes in all tidal channels and sloughs in and around Suisun Marsh would be highly variable.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Although tidal habitat restoration might increase methylation of mercury export to other habitats, restoration is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. Robinson et al. (2011) found toxic levels of methylmercury levels in song sparrow populations from southern San Francisco Bay, although populations near Suisun Marsh (i.e., San Pablo and Simas Creeks) were much lower. The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. The Suisun Marsh Plan anticipates that restored tidal wetlands would generate less methylmercury than the existing managed wetlands to be restored (Bureau of Reclamation et al. 2010).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Suisun song sparrow and saltmarsh common yellowthroat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Suisun song sparrow and saltmarsh common yellowthroat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Suisun song sparrow and saltmarsh common yellowthroat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances would not have an adverse effect on Suisun song sparrow with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects of noise and visual disturbance on saltmarsh common yellowthroat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills, and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration would be expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration is unlikely to have a substantial impact on Suisun song sparrow and saltmarsh common yellowthroat through increased exposure to methylmercury, as these species currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*. Changes in salinity gradients would be expected to have a beneficial impact on Suisun song sparrow and saltmarsh common yellowthroat through the establishment of tidal marsh similar to historic conditions.

The implementation of tidal natural communities restoration (CM4) is unlikely to significantly increase the exposure of methylmercury to Suisun song sparrow or saltmarsh common yellowthroat, as they currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With implementation of these avoidance and minimization measures, Mitigation Measure BIO-75, and CM12, indirect effects of Plan implementation would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the study area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the study area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Appendix 5.J, Attachment5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the plan area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

***NEPA Effects*:** The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 1C would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-1C-35. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the Swainson's hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM3 and CM11).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM3 and CM11).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Conserve at least 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat (Objective SH1.1, associated with CM3).
- Protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Of the at least 42,275 acres of cultivated lands protected as Swainson's hawk foraging habitat under Objective SH1.2, up to 1,500 acres can occur in CZs 5 and 6, and must have land surface elevations greater than −1 foot NAVD88 (Objective SH1.3, associated with CM3).
- Protect at least 10,750 acres of grassland, vernal pool, and alkali seasonal wetland as Swainson's hawk foraging habitat (Objective SH1.4, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and the implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk,* impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-35. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	32	32	64	64	NA	NA
	Foraging	4,920	4,920	6,895	6,895	NA	NA
Total Impacts CM1		**4,952**	**4,952**	**6,959**	**6,959**	**NA**	**NA**
CM2–CM18	Breeding	252	412	54	85	41–70	189
	Foraging	8,903	48,511	504	1,540	3,025–6,635	8,008
Total Impacts CM2–CM18		**9,155**	**48,923**	**558**	**1,625**	**3,066-6,705**	**8,197**
Total Breeding		**284**	**444**	**118**	**149**		189
Total Foraging		**13,823**	**53,431**	**7,399**	**8,435**		8,008
TOTAL IMPACTS		**14,107**	**53,875**	**7517**	**8584**		**8,197**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 62,459 acres of modeled habitat (593 acres of nesting habitat and 61,866 acres of foraging habitat) for Swainson's hawk (Table 12-1C-35). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian habitat restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 96 acres of Swainson's hawk nesting habitat (32 acres of permanent loss habitat and 64 acres of temporary loss). Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. In addition, 11,815 acres of foraging habitat would be removed (4,920 acres of permanent loss, 6,895 acres of temporary loss; Table 12-1C-35). The permanent losses of foraging habitat would occur at various locations along the western canal route, at the intake sites along the Sacramento River, construction of the new forebay, and associated RTM storage areas. Both temporary and permanent losses of foraging habitat would occur from the transmission line corridors west of the study area and along the tunnel alignment in the west Delta. Temporary losses would occur from siphon construction areas, safe haven work areas, railroad work areas, and potential borrow and spoil sites along the canal alignment. habitat impacts from CM1 would include the permanent loss of 1,012 acres and the temporary loss of 1,256 acres of very high-value habitat (alfalfa; Table 12-1C-36). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. The CM1 construction footprint overlaps with 20 Swainson's hawk occurrences in the study area. Eight occurrences overlap with permanent impacts from the construction of the canal, the permanent transmission line, intakes, shafts and siphons. In addition, twelve occurrences overlap with temporary impacts from work areas and the temporary transmission line alignment. The implementation of *AMM18 Swainson's Hawk*, would require preconstruction surveys and the establishment of no-disturbance buffers and would minimize potential effects on nesting Swainson's hawks present within or adjacent to construction areas. Impacts from CM1 would occur within the first 10 years of Alternative 1C implementation.

Table 12-1C-36. Acres of Impacted Swainson's Hawk Foraging Habitat by Value Classes

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	CM1 Permanent (temporary)	CM2-18 permanent (temporary)
Very high	Alfalfa hay	1,012 (1,256)	13,898 (432)
Moderate	Irrigated pasture, other hay crops, tomatoes, grain crops (wheat, barley, oats), fallow fields	1,441 (2,450)	15,136 (477)
Low	Other irrigated field and truck crops, dry pasture, grasslands, alkali seasonal wetlands, vernal pool complex, sudan	944 (1,413)	10,535 (349)
Very low	Safflower, sunflower, corn, grain sorghum, managed wetlands	1,522 (1,777)	8,943 (281)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 133 acres of nesting habitat (79 acres of permanent loss, 54 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,500 acres of foraging habitat would be removed (996 acres of permanent loss, 554 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the

Sacramento Weir would also remove Swainson's hawk habitat. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 295 acres of Swainson's hawk nesting habitat and 37,359 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. Impacts on foraging habitat from CM4 would consist of 10,757 acres of very high-value (alfalfa), 11,706 acres of moderate-value, and 7,973 acres of low-value habitat (See Table 12-1C-36 for land cover types classified by habitat value). Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. However, the conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM4, suggesting that numerous nest sites could be directly affected by inundation from tidal restoration activities.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 69 acres of Swainson's hawk nesting habitat (38 acres of permanent loss, 31 acres of temporary loss) and 2,856 acres of foraging habitat (1,820 acres of permanent loss, 1,036 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 953 acres of Swainson's hawk foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of Swainson's hawk agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of Swainson's hawk foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 1,440 acres of Swainson's hawk foraging habitat in CZ 2 and CZ 4. Small patches of riparian vegetation that support Swainson's hawk nesting habitat may develop along the margins of restored nontidal marsh if appropriate site conditions are present.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of Swainson's hawk grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of Swainson's hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

  Permanent and temporary nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 1C would remove 402 acres (284 permanent, 118 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 96 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*—306 acres). In addition, 21,222 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 11,815 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 96 acres of nesting habitat should be restored/created and 96 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 11,815 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With this program in place, Alternative 1C would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 593 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 61,866 acres of foraging habitat (13% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1-4, 7- 9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Swainson's hawk habitat and potential for direct mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on Swainson's hawk under Alternative 1C would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 1C would remove 402 acres (284 permanent, 118 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 96 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 21,222 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 11,815 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 96 acres of nesting habitat should be restored/created and 96 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 11,815 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that are incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 1C would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 593 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 61,866 acres of foraging habitat (13% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration,* and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1–4, 7–9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Swainson's hawk.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. This species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the Plan Area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

NEPA Effects**:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of Plan Implementation on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. These construction activities would include water conveyance construction, tidal restoration activities, floodplain restoration, and Fremont Weir/Yolo Bypass Enhancements. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with BDCP actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

CEQA Conclusion: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 3,066–6,706 acres of modeled Swainson's hawk habitat (consisting of approximately 41–70 acres of nesting habitat and 3,025–6,635 acres of foraging habitat; Table 12-1C-35). However, project-associated inundation of areas that would not otherwise have been inundated would be expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the project-related inundation area already inundates in the bypass. Therefore, habitat conditions in the bypass would not be expected to change substantially as a result of Yolo Bypass operations. However, increased duration of inundation during years of Fremont Weir operation, may delay the period for which foraging habitat is available to Swainson's hawks by up to several weeks.

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 8,197 acres of modeled Swainson's hawk habitat (Table 12-1C-35), consisting of 189 acres of nesting and 8,008 acres of foraging habitat. Floodplain restoration would be expected to restore a more natural flood regime and sustain riparian vegetation types that support regeneration of Swainson's hawk nesting habitat. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years)

to areas that flood infrequently (e.g., every 10 years or more). Foraging habitat that is inundated after Swainson's hawks arrive in the Central Valley in mid-March could result in a periodic loss of available foraging habitat due to the reduction in available prey. Inundated habitats would be expected to recover following draw-down and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic and short term effect that is unlikely to affect Swainson's hawk distribution and abundance, or foraging use of the study area.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not have a significant impact on Swainson's hawk.

Tricolored Blackbird

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on tricolored blackbird. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass and along the southwestern perimeter of the Plan Area, breeding colonies are uncommon in the Plan Area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas within 5 miles of nesting colonies documented in the Plan Area. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the Plan Area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of tricolored blackbird modeled habitat as indicated in Table 12-1C-37. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the tricolored blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and manage at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11. (TRBL1.1).
- Protect at least 26,300 acres of moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, 50% of which is of high or very high value (TRBL1.2).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. At least 1,000 acres of which will be within 5 miles of the at least 50 acres of nesting habitat protected under Objective TRBL1.1 (Objective TRBL1.3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-37. Changes in Tricolored Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]		Habitat Type	Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	Nesting	3	3	5	5	NA	NA
		Foraging-cultivated	1,274	1,274	1,942	1,942	NA	NA
		Foraging-noncultivated	230	230	190	190	NA	NA
	Non-breeding	Roosting	0	0	11	11	NA	NA
		Foraging-cultivated	2,259	2,259	2,567	2,567	NA	NA
		Foraging-noncultivated	148	145	148	145	NA	NA
Total Impacts CM1			**3,914**	**3,911**	**4,863**	**4,860**		
CM2–CM18	Breeding	Nesting	13	72	75	77	11–26	30
		Foraging-cultivated	1,657	9,525	84	359	1,837–2,598	2,124
		Foraging noncultivated	704	1,991	155	184	600–1,689	355
	Non-breeding	Roosting	570	1,642	0	1	0–4	29
		Foraging-cultivated	3,747	23,955	54	420	222–1,057	2,506
		Foraging-noncultivated	459	1,341	0	3	42-191	158
Total Impacts CM2–CM18			**7,150**	**38,526**	**368**	**1,044**	**2,711**	**5,766**
Total Breeding			**3,881**	**13,095**	**2,451**	**2,757**	**2,447–4,312**	**2,509**
Total Nonbreeding			**7,183**	**29,342**	**2,780**	**3,147**	**263–1,252**	**2,694**
TOTAL IMPACTS			**11,064**	**42,437**	**5,231**	**5,904**	**2,711**	**5,766**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 48,341 acres of modeled habitat (15,852 acres of breeding habitat and 32,489 habitat) for tricolored blackbird (Table 12-1C-37). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian habitat restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent loss of 1,507 acres of tricolored blackbird breeding habitat (3 acres nesting habitat, 1,274 acres of cultivated lands, and 230 acres of noncultivated lands suitable for foraging) and 2,407 acres of nonbreeding habitat (0 acres roosting habitat, 2,259 acres of cultivated lands, and 148 acres of noncultivated lands suitable for foraging (Table 12-1C-37). Approximately 602 of the 3,914 acres permanently impacted would be lost as reusable tunnel material storage areas, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored. While this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary.

  In addition, CM1 would result in the temporary removal of 2,137 acres of breeding habitat (5 acres nesting habitat, 1,942 acres of cultivated lands, and 190 acres of noncultivated lands suitable for foraging) and 2,726 acres of nonbreeding habitat (11 acres roosting habitat, 2,567 acres of cultivated lands, and 148 acres of noncultivated lands suitable for foraging, Table 12-1C-37). Most of the habitat that would be lost is located in the central Delta, from CZs 3, 5, 6, 8, and 9. There are no occurrences of tricolored blackbird that overlap with the construction footprint for CM1. However, records exist throughout the study area. The implementation of *AMM21 Tricolored Blackbird* would require preconstruction surveys and the establishment of no-disturbance buffers and would minimize potential effects on nesting tricolored blackbirds (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would permanent loss of 595 acres of tricolored blackbird breeding habitat (13 acres nesting habitat, 477 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 8 acres of nonbreeding habitat (consisting entirely of roosting habitat). In addition, CM2 construction would result in the temporary removal of 314 acres of breeding habitat (75 acres nesting habitat, 84 acres of cultivated lands, and 155 acres of noncultivated lands suitable for foraging) and 54 acres of nonbreeding habitat (consisting entirely of cultivated lands). The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 3,937 acres of tricolored blackbird breeding habitat (21 acres of nesting, 2,814 acres of cultivated lands, and 1,102 acres of noncultivated lands suitable for foraging) and 10,794 acres of nonbreeding habitat (1,633 acres of roosting, 18,489 acres of cultivated lands, and 672 acres of noncultivated lands suitable for foraging). An estimated 13,692 acres of the 28,424 acres to be permanently lost would be expected to convert to tidal emergent wetland communities that could provide nonbreeding season roosting habitat for tricolored blackbirds, depending on future vegetation density and composition. Conversion would result in the loss of an estimated 4,316 acres of tricolored blackbird breeding habitat (34 acres of nesting habitat; plus 3,635 acres of cultivated lands and 647 acres of noncultivated habitats suitable for foraging) and 9,375 acres of nonbreeding habitat (8,716 acres of cultivated lands and 659 acres of noncultivated habitats suitable for foraging). These habitat losses and conversions would occur in CZs 1, 2, 4, 5, 6, 7, 8, and 11. Although considered to be a permanent loss, due to the uncertainty of the quantity of restored suitable habitat, any areas that develop into riparian scrub-shrub could provide suitable nesting and roosting habitat for tricolored blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction and riparian restoration associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent removal of up to 554 acres of tricolored blackbird breeding habitat (4 acres of nesting habitat, 503 acres of cultivated lands, and 47 acres of noncultivated habitats suitable for foraging) and 656 acres of nonbreeding habitat (1 acre of roosting habitat, 652 acres of cultivated lands, and 3 acres of noncultivated habitats suitable for foraging) in CZ 7. Patches of riparian scrub associated with the restoration of approximately 1,000 acres of valley/foothill riparian habitat managed as early- to mid-successional habitats (as a component of CM5) could provide suitable nesting, roosting or foraging habitat for tricolored blackbird once these restored habitats have developed habitat functions for the species.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland would result in the permanent removal of 1,521 acres of tricolored breeding habitat and 210 acres of nonbreeding habitat. Grassland restoration would be implemented on cultivated lands and would therefore result in the conversion of tricolored blackbird cultivated foraging habitat to high-value grassland foraging habitat in CZs 2, 4, and 5.

- *CM10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 568 acres of tricolored blackbird breeding habitat and 945 acres of nonbreeding habitat (all cultivated lands suitable for foraging). About two-thirds of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide low-value roosting habitat for tricolored blackbird depending on vegetation density and composition.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 43.5 acres of breeding habitat and 6.5 acres of nonbreeding habitat (all grassland suitable for foraging) would be lost as a result of construction of trails and facilities. Impacts from recreational-related facilities that would occur within the first 10 years of Alternative 1C implementation would include a loss of 13 acres of breeding habitat.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of tricolored blackbird grassland foraging habitat in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 250 feet, from an active tricolored blackbird nesting colony. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 6,332 acres of breeding habitat (96 acres of nesting, 4,957 acres of cultivated lands, and 1,279 acres of noncultivated lands suitable for foraging) and 9,963 acres of nonbreeding habitat (581 acres of roosting, 8,627 acres of cultivated lands, and 755 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 3,644 acres of breeding, 5,133 acres of nonbreeding habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding habitat).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 8 acres of restoration and 8 acres of protection of nesting habitat, 11 acres of restoration and 11 acres of protection of roosting habitat, 1,432 acres of protection of noncultivated lands that provide foraging habitat, 3,216 acres of protection of cultivated lands suitable for foraging during the breeding season, and 4,826 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 96 acres of restoration and 96 acres of protection for nesting habitat, 581 acres of restoration and 581 acres of protection for roosting habitat, 4,068 acres of protection of noncultivated foraging habitat, 4,957 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 8,627 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1C-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley/foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in an adverse effect on tricolored blackbird.

Table 12-1C-38. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies	Corn, sunflower, millet, alfalfa and mixed alfalfa, mixed pasture, native pasture, induced high water table native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grass pasture, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Wheat, mixed grain and hay, farmsteads	Wheat, oats, mixed grain and hay, farmsteads
Marginal	Rice	None
None	All remaining crop types	All remaining crop types

[a] Generally March through August; occasional breeding in fall (September through November).

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP Chapter 5, *Effects Analysis*). Alternative 1C as a whole would result in the permanent loss of and temporary effects on 15,852 acres of breeding habitat and 32,489 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (10% of the total breeding habitat in the study area and 13% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*). In addition,

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1C-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The losses of tricolored blackbird habitat and potential for direct mortality of a special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM5, CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7 and *AMM21 Tricolored Blackbird*, which would be in place throughout the construction period, the effects of habitat loss or potential for mortality on tricolored blackbird would not be adverse under Alternative 1C.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 6,332 acres of breeding habitat (96 acres of nesting, 4,957 acres of cultivated lands, and 1,279 acres of noncultivated lands suitable for foraging) and 9,963 acres of nonbreeding habitat (581 acres of roosting, 8,627 acres of cultivated lands, and 755 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 3,644 acres of breeding, 5,133 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 8 acres of restoration and 8 acres of protection of nesting habitat, 11 acres of restoration and 11 acres of protection of roosting habitat, 1,432 acres of protection of noncultivated lands that provide foraging habitat, 3,216 acres of protection of cultivated lands suitable for foraging during the breeding season, and 4,826 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 96 acres of restoration and 96 acres of protection for nesting habitat, 581 acres of restoration and 581 acres of protection for roosting habitat, 4,068 acres of protection of noncultivated foraging habitat, 4,957 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 8,627 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-1C-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley/foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in a significant impact on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP Chapter 5, *Effects Analysis*). Alternative 1C as a whole would result in the permanent loss of and temporary effects on 15,852 acres of breeding habitat and 32,489 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (10% of the total breeding habitat in the study area and 13% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). In addition,

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-1C-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 1C as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

There are three other factors relevant to effects on tricolored blackbird.

- Very little loss of nesting structure would occur (up to 81 acres of permanent loss and 93 acres of temporary loss).
- Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the Plan Area, so the loss is not expected to adversely affect the population in the Plan Area.
- Most temporary impacts would be to cultivated lands and grasslands that could be restored relatively quickly to suitable foraging habitat after completion of construction activities.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 1C as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area). Although migratory movements and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the Plan Area currently poses these risks, and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on tricolored blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 1C would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of Plan Implementation on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1.900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 250 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony or roost site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury.

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. Furthermore, the Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands, potentially reducing the overall risk. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community and floodplain restoration could indirectly affect tricolored blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants* of the BDCP).

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1-AMM7, AMM21, AMM27, and CM12 in place, the indirect effects of Alternative 1C implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 2,447–4,312 acres of breeding habitat and 263–1,252 acres of nonbreeding habitat (Table 12-1C-37). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 2,509 acres of breeding habitat (30 acres of nesting, 2,124 acres of cultivated lands, 355 acres of noncultivated lands suitable for foraging) and 2,694 acres of nonbreeding habitat(29 acres of roosting, 2,506 acres of cultivated lands, 158 acres of noncultivated lands suitable for foraging, Table 12-1C-37) resulting in the temporary loss of these habitats. Tricolored blackbirds are highly nomadic during the winter and would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat. There would be no expected adverse effect on tricolored blackbird.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would not result in an adverse effect on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would have a less-than-significant impact on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

Western Burrowing Owl

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-1C-39. Full implementation of Alternative 1C also include the following conservation actions over the term of the BDCP to benefit the western burrowing owl (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 1,000 acres of cultivated lands in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 mile of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1, associated with CM3).
- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands and vernal pool complex in CZs 1, 8, and/or 11 to achieve no net loss of wetted acres (Objectives ASWNC1.2 and VPNC1.2, associated with CM9)

- Increase burrow availability and prey abundance and accessibility (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, VPNC2.5, GNC2.3, and GNC2.4, associated with CM11)
- Protect at least 48,600 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species and maintain and protect the small patches of important wildlife habitats associated with cultivated lands (Objectives CLNC1.1 and CLNC1.3, associated with CM3)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activates that would enhance habitat for the species and the implementation of AMM1–AMM7, *AMM23 Western Burrowing Ow*l, and Mitigation Measures BIO-91 and BIO-91a, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-39. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	1,052	1,052	1,447	1,447	NA	NA
	Low-value	3,067	3,067	3,492	3,492	NA	NA
Total Impacts CM1		**4,119**	**4,119**	**4,939**	**4,939**		
CM2–CM18	High-value	4,487	11,570	245	328	1,390–3,303	779
	Low-value	3,527	28,506	144	971	1,522–2,927	6,162
Total Impacts CM2–CM18		**8,014**	**40,076**	**389**	**1,299**	**2,912–6,230**	**6,941**
Total High-value		**5,539**	**12,622**	**1,692**	**1,775**	**1,390–3,303**	**779**
Total Low-value		**6,594**	**31,573**	**3,636**	**4,463**	**1,522–2,927**	**6,162**
TOTAL IMPACTS		**12,133**	**44,195**	**5,328**	**6,238**	**2,912–6,230**	**6,941**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 50,460 acres of modeled habitat for western burrowing owl (of which 14,397 acres is high-value habitat and 36,063 acres is low-value 14,397, Table 12-1C-39). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*. The majority of habitat loss (29,668 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 2,499 acres of acres of modeled high-value western burrowing owl habitat (1,052 acres of permanent loss, 1,447 acres of temporary loss) from CZs 3, 5, 6, and 8. In addition, 6,559 acres of low-value burrowing owl habitat would be removed (3,067 acres of permanent loss, 3,492 acres of temporary loss). The majority of high-value grassland that would be removed would be in CZ 8, west of the Clifton Court Forebay. There is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from construction could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat.

  The footprint of the canal overlaps with five burrowing owl occurrences to the southwest of Clifton Court Forebay and two occurrences east of the town of Knightsen. In addition, two occurrences east of Knightsen overlap with a RTM storage area adjacent to the canal. The footprint of a proposed temporary transmission line south of Dutch Slough also overlaps with one western burrowing owl occurrence and there are several occurrences west of the new forebay that could be indirectly affected by construction activities. The implementation of AMM23 *Western Burrowing Owl* would require breeding season and nonbreeding season surveys to be conducted where burrowing owl habitat (or sign) was encountered within and adjacent to (within 150 meters) a proposed project area. Prior to any ground disturbance related to covered activities, a qualified biologist would conduct preconstruction surveys in areas identified in the habitat surveys as having suitable burrowing owl burrows. If evidence of western burrowing owls was found during the breeding season (February 1–August 31), the project proponent would avoid all nest sites that could be disturbed by project construction during the remainder of the breeding season or while the nest is occupied by adults or young (occupation includes individuals or family groups foraging on or near the site following fledging). Avoidance would include establishment of a 50- to 500-meter nondisturbance buffer around nests. If evidence of western burrowing owl is detected during the nonbreeding season (September 1–January 31), the project proponent will establish a 50- to 500-meter nondisturbance buffer around occupied burrows as determined by a qualified biologist.

  The implementation of *AMM6 Disposal and Reuse of Spoils* and *AMM23 Western Burrowing Owl* would require that, to the extent practicable, the reusable tunnel material storage area footprint avoid locations where active burrows are present. If avoidance is not possible, such as for those occurrences that overlap with the footprint of the canal, passive relocation would be considered in consultation with CDFW. If owls were to be excluded from existing burrows, artificial burrows would be used if it were possible for them to be installed within 100 meters of the existing burrows on protected lands. However, if owls were present, relocation could still constitute an adverse effect. A substantial portion of the high-value grassland protection and enhancement under *CM8 Grassland Natural Community Restoration* would be expected to occur to the west and to the south of these occurrences in CZ 8, which would provide high-value protected lands in close proximity to the disturbed habitat. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,127 acres of high-value western burrowing owl habitat (882 acres of permanent loss, 245 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 242 acres of low-value habitat would be removed (98 acres of permanent loss, 144 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1C implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 29,668 acres of modeled western burrowing owl habitat in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. The majority of removed or converted acres (19,739 acres) is composed of low-value habitat. However, 9,929 acres of high-value habitat would also be lost from tidal restoration actions. Tidal restoration would directly impact and fragment remaining high-value grassland habitat just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Tidal natural community restoration efforts would impact one extant record of burrowing owl just northeast of Oakley along Dutch Slough and one possibly extirpated record in Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,504 acres of modeled western burrowing owl in CZs 2, 4, and 7. This total is comprised of 2,279 acres of low-value habitat. Also, 225 acres of high-value grassland habitat would be removed (142 permanent, 83 temporary) consisting of small patches of habitat along the San Joaquin, Old, and Middle Rivers in CZ 7.
- *CM6 Channel Margin Enhancement*: Sites for channel margin enhancement would be located along levees where western burrowing owl could be present. The species is known to use often the grassland edges along canals and levees in agricultural areas. The implementation of *AMM23 Western Burrowing Owl* would reduce the potential for channel margin enhancement activities to disturb owls or affect active nests.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 11 acres of high-value burrowing owl habitat as part of tidal restoration. In addition, 960 acres of low-value habitat would be removed as a part of tidal restoration and 3,991 acres would be removed as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would primarily be implemented on agricultural lands and would result in the permanent loss of 1,676 acres (362 acres of high-value and 1,314 acres of low-value) of western burrowing owl habitat. The conversion of 1,676 acres of low-value habitat to high-value grassland, would temporarily remove available habitat but would ultimately have a beneficial effect on the western burrowing owl.
- *CM10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 159 acres of high-value and 952 acres of low-value western burrowing owl habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activates and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* into the BDCP which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value western burrowing owl habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 5,964 acres (5,368 acres permanent, 596 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,232 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 7,373 acres of low-value habitat would be removed or converted in the near-term (CM1, 3,702 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for western burrowing owl in Chapter 3 of the BDCP would be 2:1 protection for the loss of high-value habitat and 1:1 protection for the loss of low-value habitat. Using these typical ratios would indicate that 4,998 acres should be protected to mitigate the CM1 losses of high-value habitat, and 6,559 acres protected to compensate for loss of low-value western burrowing owl habitat. The near-term effects of other conservation actions would require the protection of 9,464 acres of high-value habitat 3,671 acres of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for loss of high-value habitat and 1:1 protection for loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on western burrowing owl high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of high-value burrowing owl habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for the Near-Term Loss of High-Value Burrowing Owl Habitat*, would be available to address the adverse effect of high-value habitat loss in the near-term.

The compensation for the loss of low-value burrowing owl habitat from the other near-term impacts would be 5,632 acres less than the typical ratio of 1:1 protection. However, 3,636 acres of all near-term impacts on low-value habitat would be temporary and would be restored within 1 year of the completion of construction. In addition, a proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat. The near-term conservation acres would be 1,996 acres short of compensating for the permanent impacts on low-value habitat for the species. Mitigation Measure BIO-91a, *Compensate for Permanent Loss of Low-Value Western Burrowing Owl Habitat*, would compensate for the loss of permanent low-value habitat in the near-term. The management and enhancement of cultivated lands and protected grasslands, including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any adverse effect from the near-term loss of low-value foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan,* and *AMM23 Western Burrowing Owl*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the Plan Area supports approximately 128,781 acres of high-value and 234,903 acres of low-value habitat for western burrowing owl. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 14,397 acres of high-value habitat and 36,063 acres of low-value habitat for western burrowing owl during the term of the Plan (11% of the total primary habitat in the Plan Area and 15% of the total low-value habitat in the study area).

The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration*, and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives

ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects**:** The loss of western burrowing owl habitat and potential for mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM23 Western Burrowing Owl*, and with implementation of Mitigation Measures BIO-91 and BIO-91a, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl would not be adverse under Alternative 1C.

CEQA Conclusion**:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 5,964 acres (5,368 acres permanent, 596 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,232 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 7,373 acres of low-value habitat would be removed or converted in the near-term (CM1, 3,702 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for western burrowing owl in Chapter 3 of the BDCP would be 2:1 protection for the loss of high-value habitat and 1:1 protection for the loss of low-value habitat. Using these typical ratios would indicate that 4,998 acres should be protected to mitigate the CM1 losses of high-value habitat, and 6,559 acres protected to compensate for loss of low-value western burrowing owl habitat. The near-term effects of other conservation actions would require the protection of 9,464 acres of high-value habitat 3,671 acres of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for loss of high-value habitat and 1:1 protection for loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

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The compensation for the loss of low-value burrowing owl habitat from the other near-term impacts would be 5,632 acres less than the typical ratio of 1:1 protection. However, 3,636 acres of all near-term impacts on low-value habitat would be temporary and would be restored within 1 year of the completion of construction. In addition, a proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat. The near-term conservation acres would be 1,996 acres short of compensating for the permanent impacts on low-value habitat for the species. Mitigation Measure BIO-91a, *Compensate for Permanent Loss of Low-Value Habitat for Western Burrowing Owl* would compensate for the loss of permanent low-value habitat in the near-term. The management and enhancement of cultivated lands and protected grasslands, including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any impact from the near-term loss of low-value foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operation Plan,* and *AMM23 Western Burrowing Owl*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the Plan Area supports approximately 128,781 acres of high-value and 234,903 acres of low-value habitat for western burrowing owl. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 14,397 acres of high-value habitat and to 36,063 acres of low-value habitat for western burrowing owl during the term of the Plan (11% of the total primary habitat in the Plan Area and 15% of the total low-value habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration*, and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7, *AMM23 Western Burrowing Owl,* and Mitigation Measures BIO-91 and BIO-91a, which would be available to guide the near-term protection and management of cultivated lands, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western burrowing owl.

Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

Because the BDCP lacks an acreage commitment for specific crop types that would be managed within the 15,400 acres of cultivated lands protected in the near-term time period, DWR will compensate for the loss of high-value burrowing owl habitat with high-value natural communities or cultivated crop types a ratio of 2:1 in the near-term time period.

Mitigation Measure BIO-91a: Compensate for Permanent Loss of Low-Value Western Burrowing Owl Habitat

DWR will compensate for the near-term permanent loss of low-value habitat at a ratio of 1:1.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given its physical and behavioral characteristics (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). and new transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed for the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed for the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of Plan Implementation on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of up to 13,922 acres of modeled burrowing owl habitat (6,113 acres of high-value habitat) within 500 feet of covered activities will temporarily be made less suitable as a result of construction noise and visual disturbances adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with incorporation of *AMM23 Western Burrowing Owl* into the BDCP, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

NEPA Effects: Indirect effects on western burrowing owl as a result of Alternative 1C implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, the indirect effects from Alternative 1C implementation would not be adverse under NEPA.

CEQA Conclusion: Indirect effects on western burrowing owl as a result of Alternative 1C implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 1C implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,390–3,303 acres of high-value habitat and 1,522–2,927 acres of low-value habitat (Table 12-1C-39).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 6,941 acres of modeled habitat (6,162 acres, of which would be low-value foraging habitat; Table 12-1C-39).

Burrowing owls cannot use inundated areas for foraging or nesting, and increased inundation frequency and duration of cultivated lands and grassland habitats may affect prey populations that have insufficient time to recover following inundation events. Depending on timing, seasonal inundation of western burrowing owl habitat could result in displacement from nesting burrows or drowning of individuals. The potential for this effect is considered low because suitable burrow sites would most likely be located along setback levees, which are expected to be subject to inundation less frequently than floodplain surfaces that would be less likely to support suitable nesting burrows.

NEPA Effects: The periodically inundated habitat would not be expected to have an adverse effect on the population. The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation; therefore, the potential impact would not be adverse.

CEQA Conclusion: The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation. Therefore, periodic inundation would be expected to have a less-than-significant impact on the population.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on western yellow-billed cuckoo. The habitat model for western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres. Modeled habitat also includes migratory habitat, which contains the same plant alliances as breeding habitat but without the minimum 50-acre patch size requirement.

The western yellow-billed cuckoo is uncommon in the Plan Area at present, and the likelihood that it would be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the plan area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of Western yellow-billed cuckoo modeled habitat as indicated in Table 12-1C-40. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the western yellow-billed cuckoo (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and the implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-40. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	0	0	0	0	NA	NA
	Migratory	13	13	35	35	NA	NA
Total Impacts CM1		**13**	**13**	**35**	**35**		
CM2–CM18	Breeding	29	142	5	10	11-20	17
	Migratory	278	383	83	94	37-64	125
Total Impacts CM2–CM18		**307**	**525**	**88**	**104**	**48-84**	**142**
Total Breeding		**29**	**142**	**5**	**10**	**11-20**	**17**
Total Migratory		**291**	**396**	**118**	**129**	**37-64**	**125**
TOTAL IMPACTS		**320**	**538**	**123**	**139**	**48-84**	**142**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 677 acres of modeled habitat for western yellow-billed cuckoo (152 acres of breeding habitat, 525 acres of migratory habitat, Table 12-1C-40). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 48 acres of modeled western yellow-billed cuckoo migratory habitat (Table 12-1C-40). Of the 48 acres of migratory habitat that would be removed for the construction of the conveyance facilities, 13 acres would be a permanent loss and 35 acres would be a temporary loss. There are no extant occurrences of yellow-billed cuckoo nests in the study area. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat for resting, protection, or foraging. Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. Temporary impacts would occur from the footprint of proposed temporary transmission lines, siphon work areas, a barge unloading facility east of Rio Vista, and a safe haven work area south of Piper Slough. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

  There would be a 6 acre increase in the combined permanent and temporary loss of western yellow-billed cuckoo breeding habitat, and a 3 acre decrease in the loss of migratory habitat (resulting in a net 3 acre increase of modeled habitat) associated with the construction of the eastern transmission line for the Alternative 1C water conveyance facility rather than the north-south transmission line.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the loss of approximately 31 acres of breeding habitat (26 acres of permanent loss and 5 acres of temporary loss) and 140 acres of migratory habitat (57 acres of permanent loss and 83 acres of temporary loss) for yellow-billed cuckoo in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1C implementation. There are no extant occurrences of yellow-billed cuckoo nesting in the study area.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 110 acres of modeled yellow-billed cuckoo breeding habitat and 310 acres of modeled migratory habitat in CZ 1, 2, 6, and 11. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove. These detections do not overlap with the hypothetical restoration areas for CM4.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 11 acres of modeled yellow-billed cuckoo breeding habitat (6 acres of permanent loss and 5 acres of temporary loss) and 27 acres of migratory habitat (16 acres of permanent loss and 11 acres of temporary loss) in CZ 7. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support western yellow-billed cuckoo habitat once the riparian vegetation has developed habitat functions for the cuckoo.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat over the term of the BDCP. With conditions favorable for its future establishment in the study area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. *CM11 Natural Communities Enhancement and Management* actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values over the term of the BDCP.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection in 2009 in DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the present of suitable habitat indicates that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 443 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 48 acres of modeled migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 48 acres of valley/foothill riparian habitat should be restored/created and 48 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 677 acres of modeled habitat (5% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7 (Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects**:** The loss of western yellow-billed cuckoo habitat associated with Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, the species is not an established breeder in the study area and its current presence is limited to migrants. In addition, the habitat lost would consist of small, fragmented riparian stands that would not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction phase, the effects of habitat loss and potential mortality under Alternative 1C on western yellow-billed cuckoo would not be adverse.

CEQA Conclusion**:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 443 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 48 acres of modeled migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 48 acres of valley/foothill riparian habitat should be restored/created and 48 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the Plan Area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 677 acres of modeled habitat (5% of the modeled habitat in the Plan Area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7 (Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Pla*n, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on western yellow-billed cuckoo from Alternative 1C would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species; however, considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a minimal effect on the species.

NEPA Effects: Fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident if the species were to occur in the study area, it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Transmission line poles and towers also provide perching substrate for raptors,

which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. Because there is low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

NEPA Effects: The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of Plan Implementation on Western Yellow-Billed Cuckoo

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: Western yellow-billed cuckoo modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Cuckoos are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on western yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the western yellow-billed cuckoo. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on western yellow-billed cuckoo.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on western yellow-billed cuckoo from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Plan implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Indirect effects on western yellow-billed cuckoo as a result of Alternative 1C implementation could have a significant impact on the species from modification of habitat.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects as a result of Alternative 1C implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 11-20 acres of modeled western yellow-billed cuckoo breeding habitat and 37–64 acres of modeled migratory habitat. No adverse effects of increased inundation frequency on western yellow-billed cuckoo or its habitat are expected because the cuckoo breeding period is outside the period the weir would be operated. In addition, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 142 acres of modeled western yellow-billed cuckoo habitat (17 acres of breeding habitat, 125 acres of migratory habitat). Inundation of restored floodplains is not expected to affect western yellow-billed cuckoo or its habitat adversely because the cuckoo breeding period is outside the period the floodplains would likely be inundated, and periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for western yellow-billed cuckoo. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for western yellow-billed cuckoo, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Periodic inundation would not have an adverse on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

White-Tailed Kite

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen 1995).

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-1C-41. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1C would also include the following biological objectives over the term of the BDCP to benefit the white-tailed kite (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM3 and CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM3 and CM11)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and the implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-41. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	33	33	71	71	NA	NA
	Foraging	4,787	4,787	6,603	6,603	NA	NA
Total Impacts CM1		**4,820**	**4,820**	**6,674**	**6,674**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
	Foraging	8,723	52,675	516	1,484	3,030–6,651	7,402
Total Impacts CM2–CM18		**9,035**	**53,182**	**604**	**1,605**	**3,078–6,733**	**7,632**
Total Nesting		**345**	**540**	**159**	**192**	**48–82**	**230**
Total Foraging		**13,510**	**57,462**	**7,119**	**8,087**	**3,030–6,651**	**7,402**
TOTAL IMPACTS		**13,855**	**58,002**	**7,278**	**8,279**	**3,078–6,733**	**7,632**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 66,281 acres of modeled habitat for white-tailed kite (732 acres of nesting habitat, 65,549 acres of foraging habitat; Table 12-1C-41). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian habitat restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 104 acres of white-tailed kite nesting habitat (33 acres of permanent loss and 71 acres of temporary loss). Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. Temporary impacts would occur from the footprint of proposed temporary transmission lines, siphon work areas, a barge unloading facility east of Rio Vista, and a safe haven work area south of Piper Slough. In addition, 11,390 acres of foraging habitat would be removed (4,787 acres of permanent loss, 6,603 acres of temporary loss, Table 12-1C-41). The permanent losses of foraging habitat would occur at various locations along the western canal route, at the intake sites along the Sacramento River, construction of the new forebay, and associated RTM storage areas. Both temporary and permanent losses of foraging habitat would occur from the transmission line corridors west of the study area and along the tunnel alignment in the west Delta. Temporary losses would occur from siphon construction areas, safe haven work areas, railroad work areas, and potential borrow and spoil sites along the canal alignment. There are no occurrences of nesting white-tailed kite that overlap with the construction footprint of CM1. However, the implementation of *AMM39 White-Tailed Kite* would minimize effects on white-tailed kites if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,525 acres of foraging habitat would be removed (1,008 acres of permanent loss, 516 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove white-tailed kite habitat. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 383 acres of white-tailed kite nesting habitat and 41,625 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of white-tailed kite nesting habitat (42 acres of permanent loss, 33 acres of temporary loss) and 2,675 acres of foraging habitat (1,706 acres of permanent loss, 968 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 971 acres of white-tailed kite foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of white-tailed kite agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value.
- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh (CM10) would result in the permanent conversion of 1,440 acres of cultivated lands to nontidal marsh in CZ 2 and CZ 4. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.
- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of white-tailed kite grassland foraging habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-white-tailed kite foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

Permanent and temporary white-tailed kite nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM39 White-Tailed Kite* in addition to conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged white-tailed kite if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM39 White-Tailed Kite* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 1C would remove 504 acres (345 acres of permanent loss, 159 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 21,229 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 11,390 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 104 acres of nesting habitat should be restored/created and 104 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 11,390 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection

and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. With this program in place, Alternative 1C would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 732 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 65,549 acres of foraging habitat (13% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide

foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite habitat and potential for direct mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM39 White-Tailed Kite*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on white-tailed kite would not be adverse under Alternative 1C.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 1C would remove 504 acres (345 acres of permanent loss, 159 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 21,229 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 11,390 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5, Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 104 acres of nesting habitat should be restored/created and 104 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 11,390 acres of foraging habitat should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection

and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With this program in place, Alternative 1C would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 732 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 65,549 acres of foraging habitat (13% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide

foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on white-tailed kite habitat from Alterative 1C would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. In particular, 95% of the loss of foraging habitat effects involve the conversion from one habitat type to another form of suitable foraging habitat. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on white-tailed kite.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of bird strike mortality from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines.

NEPA Effects**:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on white-tailed kite.

CEQA Conclusion**:** The construction and presence of new transmission lines would not represent a significant impact because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of Plan Implementation on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM39 White-Tailed Kite* would require preconstruction surveys, and if detected, 200 yard no disturbance buffers would be established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on white-tailed kite.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect white-tailed kite use of the surrounding habitat. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1C would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1C implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1C would have a less-than-significant impact on white-tailed kite with the implementation of *AMM39 White-Tailed Kite*, and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 1C implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations related to *CM2 Yolo Bypass Fisheries Enhancement* would increase the frequency and duration of inundation on approximately 48–82 acres of modeled white-tailed kite nesting habitat and 3,030–6,651 acres of modeled white-tailed kite foraging habitat (Table 12-1C-41). During inundation years, affected cultivated lands and grassland would not be available as foraging habitat until prey populations have re-inhabited inundated areas. This would result in temporary periodic reduction in availability of foraging habitat. If late-season Fremont Weir operations were to preclude the planting of some crop types, there could be a further loss of foraging habitat value if the crop type that would have been planted would provide greater foraging habitat value than the fallowed fields. No known white-tailed kite nest sites would be affected, and increased periodic flooding is not expected to cause any adverse effect on nest sites that may be within the inundation area because existing trees already withstand floods in the area, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and any nest sites would be located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to approximately 230 acres of modeled white-tailed kite nesting habitat and 7,402 acres of modeled white-tailed kite foraging habitat (Table 12-1C-41). Inundation of foraging habitat could result in a periodic reduction of available foraging habitat due to the reduction in available prey. Following draw-down, inundated habitats are expected to recover and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic impact that is unlikely to affect white-tailed kite distribution and abundance, or foraging use of the Plan Area.

Periodic inundation of floodplains (through CM2 and CM5) would be expected to restore a more natural flood regime in support of riparian vegetation types that support white-tailed kite nesting habitat. No adverse effects of inundation on white-tailed kite riparian habitat are expected because valley/foothill riparian vegetation is expected to benefit from seasonal inundation.

NEPA Effects: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would not result in an adverse effect.

CEQA Conclusion: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would be expected to have a less-than-significant impact on white-tailed kite.

Yellow-Breasted Chat

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking. For this reason, the effects analysis only provides the breakdown between primary and secondary habitat in the habitat loss totals and associated tables, and does not provide this breakdown in the text by activity or effect type.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-1C-42. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit the yellow-breasted chat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and the implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-42. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Nesting and Migratory Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Primary	8	8	32	32	NA	NA
	Secondary	6	6	12	12	NA	NA
	Suisun Marsh/ Upper Yolo Bypass	0	0	0	0	NA	NA
Total Impacts CM1		**14**	**14**	**44**	**44**	**NA**	**NA**
CM2–CM18	Primary	96	214	58	73	19–38	92
	Secondary	209	357	0	6	6–18	56
	Suisun Marsh/ Upper Yolo Bypass	76	85	29	29	23–32	0
Total Impacts CM2–CM18		**381**	**656**	**87**	**108**	**48–88**	**148**
Total Primary		**104**	**222**	**90**	**105**	**19–38**	**92**
Total Secondary		**215**	**363**	**12**	**18**	**6–18**	**56**
Total Suisun Marsh/Upper Yolo Bypass		**76**	**85**	**29**	**29**	**23–32**	**0**
TOTAL IMPACTS		**395**	**670**	**131**	**152**	**48–88**	**148**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 822 acres of modeled nesting and migratory habitat for yellow-breasted chat (670 acres of permanent loss, 152 acres of temporary loss, Table 12-1C-42). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 40 acres of primary habitat (8 acres of permanent loss, 32 acres of temporary loss). In addition, 18 acres of secondary habitat would be removed (6 acres of permanent loss, 12 acres of temporary loss, Table 12-1C-42). There are no occurrences of yellow-breasted chat that overlap with the CM1 construction footprint. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for resting, protection, or foraging. Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. Temporary impacts would occur from the footprint of proposed temporary transmission lines, siphon work areas, a barge unloading facility east of Rio Vista, and a safe haven work area south of Piper Slough. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize effects on yellow-breasted chat if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove approximately 83 acres and temporarily remove 88 acres of yellow-breasted chat habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled yellow-breasted chat habitat in CZ 1, 2, 6, and 11. This total is composed of an estimated 182 acres of primary nesting and migratory habitat, 349 acres of secondary nesting and migratory habitat, and 14 acres of nesting and migratory habitat in the Suisun Marsh and upper Yolo Bypass areas.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 49 acres of modeled yellow-breasted chat habitat in CZ 7. This total is comprised of 28 acres of primary nesting and migratory habitat and 21 acres of secondary nesting and migratory habitat. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support yellow-breasted chat habitat.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat over the term of the BDCP. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the study area.

  Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.
- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 526 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 58 acres of valley/foothill riparian habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have an adverse population-level effect on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 822 acres of modeled habitat (6% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of yellow-breasted chat habitat and potential direct mortality of this special-status species would represent an adverse effect in the absence of other conservation actions. However, the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species. The restored riparian habitat would require 5 years to several decades for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the nesting and migratory habitat that would be lost is small relative to the species range throughout California and North America, Alternative 1C would not be expected to have an adverse population-level effect on the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on yellow-breasted chat under Alternative 1C would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impact of construction would be less than significant under CEQA. Alternative 1C would remove 526 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 58 acres of valley/foothill riparian habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have a significant population-level impact on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 822 acres of modeled habitat (6% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the Plan Area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow breasted chat habitat from Alternative 1C would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-breasted chat.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Because of the current infrequent occurrence and small numbers of yellow-breasted chat in the Plan Area, and because CM5 would restore and protect contiguous high-value riparian habitat in CZ 7, any such habitat fragmentation is expected to have no or minimal effect on the species.

NEPA Effects: Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions would be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer when visibility is high. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird-strike is considered to be minimal based on the species' small, relatively maneuverable body, its foraging behavior, and its presence in the Plan Area during the summer when visibility is high. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of Plan Implementation on Yellow-Breasted Chat

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP, which would ensure 250-foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo,* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize this effect on the species.

Methylmercury Exposure: Yellow-breasted chat modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Chats are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the yellow-breasted chat. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-breasted chat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-breasted chat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. With the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased exposure to selenium would be less than significant.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–88 acres of modeled yellow-breasted chat nesting and migratory habitat. No adverse effects of increased inundation frequency on yellow-breasted chat or its habitat are expected because the chat breeding period is outside the period the weir would be operated. Moreover, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 could result in periodic inundation of up to 148 acres of modeled yellow-breasted chat habitat. Inundation of restored floodplains is not expected to affect yellow-breasted chat or its habitat because the chat breeding period is outside the period the floodplains would likely be inundated. In addition, providing for periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for yellow-breasted chat. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increases in the frequency and duration of Yolo Bypass flooding and CM5 floodplain restoration would be expected to create more natural flood regimes that would support riparian habitat, which would not result in an adverse effect on yellow breasted chat.

CEQA Conclusion: Periodic inundation would have a less-than-significant impact on yellow-breasted chat because inundation would occur outside of the breeding season and would not be expected to adversely modify habitat or result in direct mortality of the species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation would be beneficial for yellow-breasted chat.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled breeding habitat for these species is restricted to valley/foothill riparian forest.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-1C-43. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed Kite*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP which would also benefit Cooper's hawk and osprey (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the acres of restoration or protection included in the Plan, in addition to management activities to enhance natural communities for species and the implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-43. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	33	33	71	71	NA	NA
Total Impacts CM1		**33**	**33**	**71**	**71**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
Total Impacts CM2–CM18		**312**	**507**	**88**	**121**	**48–82**	**230**
TOTAL IMPACTS		**345**	**540**	**159**	**192**	**48–82**	**230**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 911 acres of modeled habitat for Cooper's hawk and osprey (Table 12-1C-43). Conservation measures that would result in these losses are *CM1 Water Facilities and Operation* (which would involve conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 104 acres of white-tailed kite nesting habitat (33 acres of permanent loss and 71 acres of temporary loss, Table 12-1C-43). Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. Temporary impacts would occur from the footprint of proposed temporary transmission lines, siphon work areas, a barge unloading facility east of Rio Vista, and a safe haven work area south of Piper Slough. These losses would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* (described below) would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on Cooper's hawk and osprey if either species were to nest in or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of Cooper's hawk and osprey nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential Cooper's hawk and osprey habitat. Mitigation Measure BIO-75 would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on cooper's hawk and osprey if either species were to nest in or adjacent to the construction footprint. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration could permanently remove up to 383 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions (CM5) would remove approximately 75 acres of Cooper's hawk and osprey nesting habitat (42 acres of permanent loss, 33 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

  Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 1C would remove 504 acres (345 acres of permanent loss, 159 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 104 acres of nesting habitat should be restored/created and 104 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. In order for the BDCP not to have an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 732 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

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NEPA Effects: The loss of Cooper's hawk and osprey habitat and potential for direct mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss on Cooper's hawk and osprey under Alternative 1C would not be adverse. Cooper's hawk and osprey are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 1C would remove 504 acres (345 acres of permanent loss, 159 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 104 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 104 acres of nesting habitat should be restored/created and 104 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting Cooper's hawk and osprey to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 732 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce this impact to a less-than-significant level.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of Plan Implementation on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cooper's hawk and osprey.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Cooper's hawk and osprey.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Cooper's hawk and osprey from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on cooper's hawk and osprey. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Cooper's hawk and osprey, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1C would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury through the ingestion of fish or small mammals in restored tidal areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would address the uncertainty of methylmercury levels in restored tidal marsh in the study area and better inform potential impacts on Cooper's hawk and osprey.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. With the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-82 acres of modeled Cooper's hawk and osprey breeding habitat However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 230 acres of breeding habitat for Cooper's hawk and osprey. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation resulting from CM2 and CM5 would not have an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation resulting from CM2 and CM5 would have a less-than-significant impact on Cooper's hawk and osprey.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-1C-44. Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP that would also benefit golden eagles or ferruginous hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-44. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	2,796	2,796	3,750	3,750	NA	NA
Total Impacts CM1		**2,796**	**2,796**	**3,750**	**3,750**	**NA**	**NA**
CM2–CM18	Foraging	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**8,246**	**28,994**	**4,126**	**4,643**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 33,688 acres of modeled foraging habitat for golden eagle and ferruginous hawk (of which 28,994 acres would be a permanent loss and 4,643 acres would be a temporary loss of habitat, Table 12-1C-44). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian habitat restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 6,546 acres of modeled golden eagle and ferruginous hawk foraging habitat (2,796 acres of permanent loss, 3,750 acres of temporary loss) from CZs 3, 5, 6, 8, and 9. The permanent losses would occur at various locations along the western canal route and at the intake sites along the Sacramento River. The majority of grassland that would be removed would be in CZ 8, west of the Clifton Court Forebay from the construction of the new forebay and the associated borrow and spoil areas. Larger areas of annual grassland would be permanently removed by canal construction south of Rock Slough, south of Discovery Bay and immediately west of Clifton Court Forebay. Both temporary and permanent losses of grassland would be created by constructing transmission corridors west of the Plan Area and along the tunnel alignment in the west Delta. Other temporary losses occur from siphon construction areas, at safe haven work areas, and at railroad work areas just southwest of Clifton Court Forebay. There are no occurrences of golden eagle or ferruginous hawk that intersect with the CM1 footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts resulting from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled golden eagle and ferruginous hawk foraging habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled golden eagle and ferruginous hawk foraging habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide foraging habitat for golden eagle and ferruginous hawk and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of golden eagle and ferruginous hawk foraging habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat for these species. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled golden eagle and ferruginous hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facility construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of such conveyance facility construction would not be adverse under NEPA. Alternative 1C would remove 12,372 acres (8,246 acres permanent, 4,126 acres temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the CM1 losses of 6,546 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk. However, the conservation commitment is 5,684 acres short of meeting the compensation for other near-term effects on golden eagle and ferruginous hawk habitat. Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, would be available to address the adverse effect of near-term habitat loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of modeled foraging habitat during the term of the Plan (13% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Communities Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of golden eagle and ferruginous hawk habitat and potential for mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the effects of habitat loss and potential for direct mortality on golden eagle and ferruginous hawk under Alternative 1C would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 12,372 acres (8,246 acres permanent, 4,126 acres temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the CM1 losses of 6,546 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson’s hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk. However, the conservation commitment is 5,684 acres short of meeting the compensation for other near-term effects on golden eagle and ferruginous hawk habitat. The implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, would reduce the near-term impact of habitat loss to less than significant.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 269,411 acres of modeled foraging habitat for golden eagle and ferruginous hawk. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of modeled foraging habitat during the term of the Plan (13% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities that would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat,* the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on golden eagle and ferruginous hawk.

Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide golden eagle and ferruginous hawk foraging habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any potential for powerline collisions.

NEPA Effects: Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on golden eagle and ferruginous hawk.

CEQA Conclusion: Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-115: Indirect Effects of Plan Implementation on Golden Eagle and Ferruginous Hawk

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1C implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1C implementation would not have an adverse effect on golden eagle and ferruginous hawk.

CEQA Conclusion: Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 1C implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 1C implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat (Table 12-1C-44).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-1C-44).

Golden eagles and ferruginous hawks would not likely use inundated areas for foraging, and increased inundation frequency and duration of inundation of grassland habitats may affect prey populations that have insufficient time to recover following inundation events. nesting burrows. Periodic inundation would at a maximum, remove 2% of the available foraging habitat in the Plan

Area. Thus, periodically inundated habitat would not be expected to have an adverse effect on local or migratory golden eagles or the wintering ferruginous hawk population in the area.

NEPA Effects: Implementation of CM2 and CM5 would increase the frequency and duration of inundation of modeled golden eagle and ferruginous hawk foraging habitat. However, periodic inundation would not be expected to have an adverse effect on the wintering golden eagle or ferruginous hawk populations in the study area.

CEQA Conclusion: Implementation of CM2 and CM5 would increase the frequency and duration of inundation of modeled golden eagle and ferruginous hawk foraging habitat. Periodic inundation would be expected to have a less-than-significant impact on the population.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-1C-45. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP which would also benefit cormorants, herons, and egrets (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activates to enhance natural communities for species and the implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measures BIO-75 and BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-45. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting (Rookeries)	40	40	86	86	NA	NA
Total Impacts CM1		**40**	**40**	**86**	**86**	**NA**	**NA**
CM2–CM18	Nesting (Rookeries)	387	684	88	123	51–92	266
Total Impacts CM2–CM18		**387**	**684**	**88**	**123**	**51–92**	**266**
TOTAL IMPACTS		**427**	**724**	**174**	**209**	**51–92**	**266**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 1,133 acres of modeled nesting habitat for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (724 acres of permanent loss, 209 acres of temporary loss, Table 12-1C-45). Conservation measures that would result in these losses are *CM1 Water Facilities and Operation* (which would involve conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 126 acres of modeled habitat for cormorants, herons, and egrets (Table 12-1C-45). Of the 126 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 40 acres would be a permanent loss and 86 acres would be a temporary loss of habitat. This loss would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. Most of the permanent loss of nesting habitat would occur where Intakes 1–5 impact the Sacramento River's west bank between just north of Clarksburg and Courtland. The riparian areas here are very small patches, dominated by valley oak, scrub vegetation, and nonnative trees. Temporary impacts would occur from the footprint of proposed temporary transmission lines, siphon work areas, a barge unloading facility east of Rio Vista, and a safe haven work area south of Piper Slough. The construction footprint for a potential borrow and spoil area south of Clifton Court road overlaps with a rookery that includes great blue heron, double-crested cormorant, and great egret nests. The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. Therefore, to avoid adverse effects on great blue herons, cormorants, and great egrets, existing rookeries must be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address this adverse effect on cormorants, herons, and egrets. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 177 acres of nesting habitat (89 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential nesting habitat. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 552 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species. There is one CNDDB occurrence of a great blue heron rookery that overlaps with the hypothetical restoration footprint for tidal restoration. The occurrence is on Decker Island and tidal restoration could potentially impact the nest trees from inundation. This potential effect would need to be addressed within the project specific analysis for tidal restoration projects.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 43 acres and temporarily remove approximately 35 acres of potential cormorants, heron, and egret nesting habitat. These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. To avoid adverse effects on these species, existing known nest sites would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address these adverse effects on cormorants, herons, and egrets.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measures BIO-75 and BIO-117would be available to address these adverse effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 601 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 126 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 126 acres of breeding habitat should be restored/created and 126 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. To avoid adverse effects on individuals, existing nests and rookeries would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address effects on nesting cormorants, herons, and egrets.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 933 acres of potential breeding habitat (5% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Communities Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites and, for the BDCP to avoid an adverse effect on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

NEPA Effects**:** The loss of cormorant, heron, and egret habitat and potential for direct mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss on cormorants, herons, and egrets under Alternative 1C would not be adverse. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address adverse effects on nesting cormorants, herons, and egrets.

CEQA Conclusion**:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under NEPA. Alternative 1C would remove 601 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 126 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 126 acres of breeding habitat should be restored/created and 126 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 933 acres of potential breeding habitat (5% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites, and, for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts sufficient to compensate for the loss of riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM18 Swainson's Hawk,* and Mitigation Measures BIO-75 and BIO-117, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of these species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed for the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on cormorants, herons, and egrets.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of Plan Implementation on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets.

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that cormorant, heron, and egret tissue concentrations would not measurably increase as a result of CM1 implementation.

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly effect on cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cormorants, herons or egrets.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets.

***CEQA Conclusion*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would represent an adverse effect in the absence of other conservation actions. This impact would be significant. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium which could result in mortality of special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species. With AMM1-AMM7, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-75 and BIO-117 measures, indirect effects of plan implementation would not result in a substantial adverse effect on cormorants, herons, and egrets through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

See Mitigation Measure BIO-117 under Impact BIO-117.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 51–92 acres of modeled breeding habitat for cormorants, herons and egrets. However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 266 acres of breeding habitat for cormorants, herons and egrets. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation from CM2 and CM5 would not result in an adverse effect on cormorants, herons and egrets.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of inundation from CM2 and CM5 would have a less-than-significant impact on cormorants, herons and egrets.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-1C-46. Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP which would benefit short-eared owl and northern harrier (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.2, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and the implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measures BIO-75 and BIO-121, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-46. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting and foraging	3,166	3,166	4,779	4,779	NA	NA
Total Impacts CM1		**3,166**	**3,166**	**4,779**	**4,779**	**NA**	**NA**
CM2–CM18	Nesting and foraging	12,281	46,700	471	1,224	2,926–8,060	5,978
Total Impacts CM2–CM18		**12,281**	**46,700**	**471**	**1,224**	**2,926–8,060**	**5,978**
TOTAL IMPACTS		**15,447**	**49,866**	**5,250**	**6,003**	**2,926–8,060**	**5,978**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 55,869 acres of modeled habitat for short-eared owl and northern harrier (of which 49,866 acres would be a permanent loss and 6,003 acres would be a temporary loss of habitat, Table 12-1C-46). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Enhancement (CM2), Tidal Natural Communities Restoration (CM4), Seasonally Inundated Floodplain Restoration (CM5), Grassland Natural Community Restoration (CM8), Vernal Pool Natural Community and Alkali Seasonal Wetland Complex Restoration (CM9), Nontidal Marsh Restoration (CM10) and Conservation Hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 7,945 acres of modeled short-eared owl and northern harrier habitat (3,166 acres of permanent loss, 4,779 acres of temporary loss) from CZs 3, 5, 6, 8, and 9. The majority of habitat removed would be grassland and cultivated lands. The permanent losses would occur at various locations along the western canal route, at the intake sites along the Sacramento River, construction of the new forebay, and associated RTM storage areas. Both temporary and permanent losses of habitat would occur from the transmission line corridors west of the study area and along the tunnel alignment in the west Delta. The CM1 footprint overlaps with two northern harrier occurrences in the study area (one temporary control structure work area and one potential borrow area in CZ 8 east of the new forebay). Mitigation Measure BIO-75 would be available to reduce adverse effects on harriers or short-eared owls nesting in the vicinity of work areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 1,021 acres of modeled short-eared owl and northern harrier habitat in the Yolo Bypass in CZ 2. In addition, 471 acres of habitat would be temporarily removed. The impact would primarily consist of loss of acreages of pastures. The conversion is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 39,017 acres of modeled short-eared owl and northern harrier habitat. The majority of the losses would be managed wetlands and cultivated lands in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. Tidal restoration actions through CM4 would restore an estimated 55,000 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the extent and value of their nesting habitat. Grizzley Island supports the only known resident population of short-eared owls in the Suisun Marsh and Sacramento-San Joaquin River Delta (Roberson 2008). Grizzley Island does not overlap with the hypothetical footprint for CM4. However, this is an important breeding area for short-eared owl and if restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding short-eared owls could likely be adverse. Future NEPA and CEQA analysis would be conducted for restoration projects under BDCP and if restoration was proposed to occur outside of the hypothetical footprints used for this programmatic analysis, potential impacts on these species would be captured in the project-level analysis (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,086 acres of modeled short-eared owl and northern harrier habitat (1,332 permanent, 754 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 623 acres of short-eared owl and northern harrier habitat as part of tidal restoration and 2,479 acres of habitat as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,066 acres of cultivated lands to grassland in CZs 1, 2, 4, 5, 7, 8, and 11. The resulting 2,000 acres of grassland would provide habitat for short-eared owl and northern harrier.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize these adverse effects.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of short-eared owl and northern harrier habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 20,697 acres of modeled habitat (15,447 permanent, 5,250 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,945 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland*

Natural Community Restoration, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 7,945 acres of habitat should be restored and 7,945 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions. The acres of restoration in the near-term satisfy the project-level effects of CM1, but are 392 acres short of satisfying the compensation required for other near-term impacts. Mitigation Measure BIO-121 *Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat*, would be available to address the adverse effect of near-term habitat loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 55,869 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (14% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of short-eared owl and northern harrier habitat and potential for direct mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss from Alternative 1C would not be adverse under NEPA. Short-eared owl and northern harrier are not covered species under the BDCP, and preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the adverse effect of direct mortality on short-eared owl and northern harrier.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide

sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 20,697 acres of modeled habitat (15,447 permanent, 5,250 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,945 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 7,945 acres of habitat should be restored and 7,945 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island.

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The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions. The acres of restoration in the near-term satisfy the project-level effects of CM1, but are 392 acres short of satisfying the compensation required for other near-term impacts. The implementation of Mitigation Measure BIO-121 *Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat*, would reduce the impact of near-term habitat loss to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 55,869 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (14% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce the impact to a less-than-significant level.

In the absence of other conservation actions, effects on short-eared owl and northern harrier would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measures BIO-75 and BIO-121, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See discussion of Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat

DWR will restore and protect sufficient acres of suitable nesting habitat for short-eared owl and northern harrier such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 1:1. Restored habitat could consist of grassland or managed wetlands.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed for the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1C would not result in an adverse effect on short-eared owl or northern harrier.

CEQA Conclusion: The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed for the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 1C would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of Plan Implementation on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to short-eared owl and northern harrier could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on short-eared owl and northern harrier.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce short-eared owl and northern harrier use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Tidal habitat restoration is unlikely to have an adverse effect on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for short-eared owl and northern harrier, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on short-eared owl and northern harrier with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. Tidal habitat restoration is unlikely to have a significant impact on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1C implementation would would result in a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 2,926–8,060 acres of modeled short-eared owl and northern harrier habitat (Table 12-1C-46).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 5,978 acres of modeled habitat (Table 12-1C-46), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

***NEPA Effects*:** Periodic inundation of floodplains would not result in an adverse effect on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

***CEQA Conclusion*:** Periodic inundation of floodplains would not have a significant impact on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in the *General Terrestrial Biology Effects* section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on mountain plover. Modeled habitat for mountain plover consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1C-47. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit the mountain plover (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).

- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-47. Changes in Mountain Plover Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Wintering	2,796	2,796	3,750	3,750	NA	NA
Total Impacts CM1		**2,796**	**2,796**	**3,750**	**3,750**	**NA**	**NA**
CM2–CM18	Wintering	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**8,246**	**28,994**	**4,126**	**4,643**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 33,668 acres of modeled habitat for mountain plover (28,994 acres of permanent loss and 4,643 of temporary loss, Table 12-1C-47). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 6,546 acres of modeled mountain plover habitat (2,796 acres of permanent loss, 3,750 acres of temporary loss) from CZs 1, 3, 5, 6, 8, and 9. The majority of habitat that would be removed would be in CZ 8, west of the Clifton Court Forebay from the construction of the new forebay and the associated borrow and spoil areas. Larger areas of annual grassland would be permanently removed by canal construction south of Rock Slough, south of Discovery Bay and immediately west of Clifton Court Forebay. Both temporary and permanent losses of grassland would be created by constructing the transmission corridor west of the Plan Area and along the tunnel alignment in the west Delta. The transmission corridor in the western tail of the study area as it is currently designed, would consist of a permanent 230 kV transmission line parallel to Flannery Road, which is an important wintering area for mountain plover. Mountain plovers use the grasslands, pastures, and recently plowed fields in this area for foraging during winter months. Existing transmission lines in the western tail include two 500 kV lines that intersect Canright Road, in addition to a 500 kV line and a 230 kV line that intersect Lambie Road at the western end of the study area. The construction of the new transmission line along Flannery Road would be expected to cause temporary disturbance to mountain plovers if construction were to occur during the winter months. However, mountain plovers tend to forage in open areas and are more likely to use areas of pastures and fields that are not in close proximity to roads. Foraging individuals would be expected to move to adjacent suitable habitat north of Flannery Road during construction. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled mountain plover wintering habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled mountain plover habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of mountain plover wintering habitat as part of tidal restoration and 1,489 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide wintering habitat for mountain plover and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of mountain plover habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available mountain plover habitat. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled mountain plover habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 12,372 acres (8,246 acres permanent, 4,126 acres temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the CM1 losses of 6,546 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on mountain plover wintering in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand mountain plover wintering habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also modeled habitat for wintering mountain plover. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for mountain plover.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the adverse effect of habitat loss resulting from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on mountain plover habitat. Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for mountain plover. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of modeled mountain plover wintering habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential wintering habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of mountain plover habitat and potential for mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the effects of habitat loss and potential for direct mortality on mountain plover under Alternative 1C would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 12,372 acres (8,246 acres permanent, 4,126 acres temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the CM1 losses of 6,546 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on mountain plover. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential habitat for mountain plover wintering in the study area. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide habitat for mountain plover.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the significant impact of habitat loss resulting from CM1. The conservation commitment is 7,572 acres short of meeting the compensation for other near-term effects on mountain plover habitat. Implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would reduce the impacts of near-term habitat loss to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of mountain plover habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types for Swainson's hawk under Objective SH1.2) which would also provide habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on mountain plover would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on mountain plover.

Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide habitat for mountain plover such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

The transmission corridor in the western tail of the study area as it is currently designed, would consist of a permanent 230 kV transmission line parallel to Flannery Road, which is an important wintering area for mountain plover. Mountain plovers use the grasslands, pastures, and recently plowed fields in this area for foraging during winter months. Existing transmission lines in the western tail include two 500 kV lines that intersect Canright Road, in addition to a 500 kV line and a 230 kV line that intersect Lambie Road at the western end of the study area. Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and, therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

NEPA Effects: New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on mountain plover.

CEQA Conclusion: New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of Plan Implementation on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on mountain plover as a result of Alternative 1C implementation could have adverse effects on the species through the modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 1C implementation would not have an adverse effect mountain plover.

CEQA Conclusion: Indirect effects on mountain plover as a result of Alternative 1C implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 1C implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,884-3,813 acres of modeled mountain plover foraging habitat (Table 12-1C-47).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 7,082 acres of modeled habitat (Table 12-1C-47). Periodic inundation from CM2 and CM5 would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

***NEPA Effects*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, periodic inundation would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

***CEQA Conclusion*:** Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, periodic inundation would have a less-than-significant impact on mountain plover because birds would be expected to move to adjacent foraging habitat.

Black Tern

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled habitat for black tern as indicated in Table 12-1C-48. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit the black tern (BDCP Chapter 3, *Conservation Strategy*).

- Protect 700 acres of cultivated lands, with at least 500 acres consisting of rice land, to expand upon and buffer newly restored/created nontidal perennial habitat in CZ 2, (Objective GGS2.3, associated with CM3).
- Protect up to 1,700 acres of rice land or equivalent habitat (e.g., perennial wetland) in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake. Any remaining acreage (from a total 2,740 acre commitment) will consist of rice land or equivalent-value habitat outside the Yolo Bypass in CZs 1, 2, 4, or 5 (Objective GGS3.1, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

As explained below, with the restoration and protection of these amounts of habitat, in addition to management activities that would enhance this habitat for the species, implementation of AMM1–AMM7, and Mitigation Measure BIO-75, impacts on black tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-48. Changes in Black Tern Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	306	490	1	1	791–1,582	0
Total Impacts CM2–CM18		**306**	**490**	**1**	**1**	**791–1,582**	**0**
TOTAL IMPACTS		**306**	**490**	**1**	**1**	**791–1,582**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

Alternative 1C conservation measures would result in the permanent loss of up to 491 acres of modeled nesting habitat for black tern, consisting of rice and freshwater wetlands in CZ 2 (Table 12-1C-48). Conservation measures that would result in these losses are Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), grassland restoration (CM8) and nontidal marsh restoration (CM10). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 31 acres of modeled black tern habitat in the Yolo Bypass in CZ 2. In addition, 1 acre of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1C implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 199 acres of modeled black tern habitat in CZ 2.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 52 acres of rice lands to grassland in CZ 2 by the late-long time period. An estimated 30 acres of impact would occur in the first 10 years.
- *CM10 Nontidal Marsh Restoration*: Implementation of CM10 would result in the permanent removal of 208 acres of black tern nesting habitat in in CZ 2. An estimated 46 acres would be removed in the first 10 years.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could disturb nesting black terns if they were to nest in the vicinity of a worksite. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of black tern would be minimized with the implementation of and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.
- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect black tern nesting adjacent to maintenance areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged black tern individuals if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If black tern were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of Mitigation Measure BIO-75.
- Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. This potential impact is further described under Impact BIO-129c below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements,*

CM4 Tidal Natural Communities Restoration, CM8 Grassland Restoration and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to compensate for the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to avoid an adverse effect on black tern from habitat loss, protection and restoration of 307 acres of rice and/or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat,* would be available to address this adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments

through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of black tern nesting habitat and potential for mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection associated with CM3, guided by biological goals and objectives and AMM1–AMM6, which would be in place throughout the construction period, the effects of habitat loss on black tern under Alternative 1C would not be adverse. Black tern is not a covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Restoration*, and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and restored in CZ 2 to mitigate the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3 *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored and protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to compensate for black tern habitat loss, the protection and restoration of 307 acres of rice or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would reduce this potential impact to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction would be required to ensure that nests are detected and avoided.

In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, which would require 1:1 protection of habitat in CZ 2 in the near-term time frame, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, reduce the potential impact on nesting black tern to a less-than-significant level.

Considering Alternative 1C's protection provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on black tern.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat

Because there is no near-term acreage commitment associated with the protection of rice and the restoration of freshwater wetlands in CZ 2, BDCP proponents must protect and restore rice and/or freshwater wetlands at a 1:1 ratio for each acre of habitat impacted in CZ 2.

Impact BIO-129b: Indirect Effects of Plan Implementation on Black Tern

If black terns were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting black terns. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants that could affect black terns in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz

2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including black tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on black tern.

Because of the uncertainty that exists at this programmatic level of review, there could be an effect on black tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of black tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce these impacts to a less-than–significant level.

Tidal habitat restoration could result in increased exposure of black tern to selenium, which could result in the mortality of a special-status species. This impact would be significant. This impact would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With AMM27 in place, potential effects of increased exposure of black tern to selenium would be reduced to a less-than-significant impact.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Construction Implementation of Conservation Components

Flooding of the Yolo Bypass would inundate 791–1,582 acres of suitable black tern nesting habitat (land currently managed as rice in CZ 2). Inundation would occur during the nonbreeding season but could reduce the availability of nesting habitat during years that flooding extends into the nesting season (past March). Extended inundation of the Yolo Bypass would not be expected to affect black tern nesting habitat. However, if periodic inundation took land out of rice production, this could have an adverse effect on black tern nesting habitat. Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. The BDCP has committed to protect, restore and/or create up to 1,700 acres of rice in the Yolo Bypass (Objective GGS3.1). These acres of rice would be protected in areas that are less susceptible to inundation, which would benefit the black tern during years in which the magnitude and duration of inundation were increased.

NEPA Effects: Flooding of the Yolo Bypass is not expected to adversely affect nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential effect would not be adverse with the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1.

CEQA Conclusion: Flooding of the Yolo Bypass is not expected to have a significant impact on nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential impact would be reduced to a less-than-significant level by the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of nesting habitat in the Plan Area, which includes grassland, vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture. Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-1C-49.

would include the following biological objectives over the term of the BDCP which would also benefit the California horned lark and the grasshopper sparrow (BDCP Chapter 3, *Conservation Strategy*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-49. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	2,796	2,796	3,750	3,750	NA	NA
Total Impacts CM1		**2,796**	**2,796**	**3,750**	**3,750**	**NA**	**NA**
CM2–CM18	Breeding	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**8,246**	**28,994**	**4,126**	**4,643**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 33,688 acres of modeled nesting habitat for California horned lark and grasshopper sparrow (of which 28,994 acres would be a permanent loss and 4,643 acres would be a temporary loss of habitat, Table 12-1C-49). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 6,546 acres of modeled California horned lark and grasshopper sparrow habitat (2,796 acres of permanent loss, 3,750 acres of temporary loss) from CZs 1, 3, 5, 6, 8, and 9. The permanent losses would occur at various locations along the western canal route, at the intake sites along the Sacramento River, construction of the new forebay, and associated RTM storage areas. Both temporary and permanent losses of foraging habitat would occur from the transmission line corridors west of the study area and along the tunnel alignment in the west Delta. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 2 and 3 (6 occurrences), in the Stone Lakes NWR. However, the CM1 footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on California horned larks and grasshopper sparrows if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Impacts resulting from CM1 would occur within the first 10 years of Alternative 1C implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled California horned lark and grasshopper sparrow habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 1C implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled California horned lark and grasshopper sparrow nesting habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of California horned lark and grasshopper sparrow nesting habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide nesting habitat for California horned lark and

grasshopper sparrow and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10 Nontidal Marsh Restoration* would result in the permanent removal of 705 acres of California horned lark and grasshopper sparrow nesting habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled California horned lark and grasshopper sparrow habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 12,372 acres (8,246 acres permanent, 4,126 acres temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the CM1 losses of 6,546 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the adverse effect of habitat loss resulting from CM1. The conservation commitment is 5,684 acres short of meeting the compensation for other near-term effects on California horned lark and grasshopper sparrow habitat. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for California horned lark and grasshopper sparrow. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) and would provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of California horned lark and grasshopper sparrow habitat and potential for mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the effects of habitat loss under Alternative 1C on California horned lark and grasshopper sparrow would not be adverse under NEPA. California horned lark and grasshopper sparrow are not covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 13,316 acres (8,412 permanent, 4,904 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 7,490 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 14,980 acres should be protected to compensate for the CM1 losses of 7,490 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable crop types for these species in order to avoid the significant impact of habitat loss resulting from CM1. The conservation commitment is 5,684 acres short of meeting the compensation for other near-term effects on California horned lark and grasshopper sparrow habitat. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would address the impact of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of California horned lark and grasshopper sparrow habitat during the term of the Plan (13% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types for Swainson's hawk under Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid significant impacts on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-130, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide California horned lark and grasshopper sparrow habitat such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1 protection. Additional grassland protection, enhancement, and management may be substituted for the protection of cultivated lands.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of grasshopper sparrow and California horned lark. The potential for this risk, is considered minimal based on the flight behaviors of each species. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure. However, this would be expected to have few adverse effects on the grasshopper sparrow and California horned lark local populations.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane*, the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of grasshopper sparrow and California horned lark. However, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark based on the species' flight behaviors.

Impact BIO-132: Indirect Effects of Plan Implementation on Grasshopper Sparrow and California Horned Lark

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to grasshopper sparrow and California horned lark habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 1C implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. California horned lark and grasshopper sparrow are not covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:** Indirect effects on grasshopper sparrow and California horned lark as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See discussion of Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on Grasshopper Sparrow and California Horned Lark as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 777–2,423 acres of modeled California horned lark and grasshopper sparrow habitat (Table 12-1C-49).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 656 acres of modeled habitat (Table 12-1C-49).

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

***NEPA Effects*:** Periodic inundation of floodplains would not have adverse effects on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

***CEQA Conclusion*:** Periodic inundation of floodplains would not have a significant impact on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis consists of tidal freshwater and tidal brackish emergent wetlands, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZ 2, 4, and 11.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-1C-50. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit least bittern and white-faced ibis (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and the implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-50. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	5,134	13,063	45	45	961–2,672	NA
Total Impacts CM2–CM18		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**
TOTAL IMPACTS		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 1C conservation measures would result in the combined permanent and temporary loss and conversion of up to 13,108 acres of modeled habitat for least bittern and white-faced ibis (13,063 acres of permanent loss and conversion and 45 of temporary loss, Table 12-1C-50). Conservation measures that would result in these losses are *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: There would be no permanent or temporary loss of least bittern and white-faced ibis habitat from the construction of the Alternative 1C conveyance facilities (Table 12-1C-50).
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 55 acres of modeled least bittern and white-faced ibis habitat in the Yolo Bypass in CZ 2. In addition, 45 acres of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 1C implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 13,008 acres of modeled least bittern and white-faced ibis habitat in CZ 2, 4, and 11 by the late long-term time period.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 described below and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce adverse effects.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 5,179 acres (5,134 acres of permanent loss, 45 acres of temporary loss) of modeled habitat for these species in the near-term. These effects would result from the implementation of *CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat would be required to compensate for the loss of habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland and protecting and enhancing 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 13,108 acres (13,063 acres of permanent loss, 45 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP and in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this potential effect.

NEPA Effects: The loss of least bittern and white-faced ibis habitat and potential mortality of these special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. However, with the habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss on least bittern and white-faced ibis would not be adverse under Alternative 1C. Least bittern and white-faced ibis are not covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 5,179 acres of modeled habitat (5,134 acres of permanent loss, 45 acres of temporary loss) for these species in the near-term. These effects would result from the implementation of *CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat would be required to compensate for the loss of habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal freshwater emergent wetland and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the potential impact on nesting least bittern and white-faced ibis to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 13,108 acres (13,063 acres of permanent loss, 45 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting least bittern and white-faced ibis and to a less-than-significant level.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters which would reduce bird strike risk of least bittern and white-faced ibis.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on least bittern and white-faced ibis.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of Plan Implementation on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to least bittern and white-faced ibis could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of other conservation actions. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

***CEQA Conclusion*:** Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of plan implementation would represent a substantial adverse effect in the absence of other conservation actions. This impact would be significant. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of plan implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other conservation measures. This would be a significant impact. With AMM1-AMM7, *AMM27 Selenium Management*, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 961-2,672 acres of modeled least bittern and white-faced ibis habitat (Table 12-1C-50). However, no adverse effects of increased inundation frequency on nesting habitat would be expected because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types. Inundation would occur in the nonbreeding season and wetlands supporting habitat would not be expected to be affected by flood flows.

***NEPA Effects*:** Periodic inundation of Yolo Bypass would not be expected to have adverse effects on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

***CEQA Conclusion*:** Periodic inundation of Yolo Bypass would not be expected to have a significant impact on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

Loggerhead Shrike

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland and alkali seasonal wetland natural communities in addition to cultivated lands, including irrigated pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-1C-51. Full implementation of Alternative 1C would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-1C-51. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit loggerhead shrike (BDCP Chapter 3, Section, 3.3, *Biological Goals and Objective*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and the implementation of AMM1–AMM7, and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-51. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	2,796	2,796	3,750	3,750	NA	NA
	Low-value	2,120	2,120	2,925	2,925	NA	NA
Total Impacts CM1		**4,916**	**4,916**	**6,675**	**6,675**	**NA**	**NA**
CM2–CM18	High-value	5,450	26,198	376	893	777-2,423	3,823
	Low-value	1,801	17,575	97	624	672-1,996	4,315
Total Impacts CM2–CM18		**7,251**	**43,773**	**473**	**1,517**	**1,830-5,646**	**8,138**
Total High-value		**8,246**	**28,994**	**4,126**	**4,643**		
Total Low-value		**3,921**	**19,695**	**3,022**	**3,549**		
TOTAL IMPACTS		**12,167**	**48,689**	**7,149**	**8,192**	**1,830-5,646**	**8,138**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 1C conservation measures would result in the combined permanent loss or conversion and temporary loss of up to 56,912 acres of modeled habitat for loggerhead shrike (of which 33,688 acres is of high-value and 23,224 acres is of low value, Table 12-1C-51). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), natural communities enhancement and management (CM11) and construction of conservation hatcheries (CM18). The majority of habitat loss (33,244 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 6,546 acres of high-value loggerhead shrike habitat (2,796 acres of permanent loss, 3,750 acres of temporary loss). In addition, 5,045 acres of low-value habitat would be removed (2,120 acres of permanent loss or conversion, 2,925 acres of temporary loss or conversion) from CZ 1, 3, 5, 6, 8, and 9. The permanent losses would occur at various locations along the western canal route and at the intake sites along the Sacramento River. The majority of grassland that would be removed would be in CZ 8, west of the Clifton Court Forebay from the construction of the new forebay and the associated borrow and spoil areas. Larger areas of annual grassland would be permanently removed by canal construction south of Rock Slough, south of Discovery Bay and immediately west of Clifton Court Forebay. Both temporary and permanent losses of grassland would be created by constructing transmission corridors west of the Plan Area and along the tunnel alignment in the west Delta. Other temporary losses occur from siphon construction areas, at safe haven work areas, and at railroad work areas just southwest of Clifton Court Forebay. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*.

  Loggerhead shrikes nest in high abundance in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Permanent impacts from CM1 that overlap with recorded loggerhead shrike nest occurrences include the construction footprint of the canal (4 occurrences), a bridge associated with Byron Highway (1 occurrence), and a siphon just south of Highway 4 (1 occurrence). The temporary impacts of potential borrow and spoil sites (4 occurrences), siphon work areas (3 occurrences), and the =footprint for a temporary transmission line east of Clifton Court Forebay (1 occurrence) also intersects with loggerhead shrike occurrences. Mitigation Measure BIO-75 would be available to address adverse effects on nesting loggerhead shrikes adjacent to work areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of high-value loggerhead shrike habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 182 acres of low-value habitat would be removed (85 acres of permanent loss, 97 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 1C implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of high-value loggerhead shrike habitat and 12,364 acres of low-value habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of high-value loggerhead shrike habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 1C implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of high-value loggerhead shrike habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration. In addition, 503 acres of low-value habitat would be removed as a part of tidal restoration and 1,971 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide habitat for loggerhead shrike and would result in the conversion of 1,849 acres of cultivated lands to high-value grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of high-value loggerhead shrike habitat and 735 acres of low-value loggerhead shrike habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Fences (e.g. barbed wire) installed as part of CM11 in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value loggerhead shrike habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. Hatchery construction is expected to occur within the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 12,372 acres (8,246 permanent, 4,126 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 6,943 acres (3,921 permanent, 3,022 temporary) of low-value habitat would be removed or converted in the near-term (CM1, 5,045 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable high-value crop types for loggerhead shrike to avoid the adverse effect of habitat loss resulting from CM1. The conservation commitment is 5,684 acres short of meeting the compensation for other near-term effects on loggerhead shrike high-value habitat. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would be available to address the adverse effect of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects. With the management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any effect from the loss of low-value loggerhead shrike foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the combined permanent of and temporary effects on 33,688 acres of high-value habitat and 23,244 acres of low-value loggerhead shrike habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7 Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***NEPA Effects*:** The loss of loggerhead shrike habitat and potential for mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, and with implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the effects of habitat loss on loggerhead shrike under Alternative 1C would not be adverse. Loggerhead shrike is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 12,372 acres (8,246 permanent, 4,126 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 6,546 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 6,943 acres (3,921 permanent, 3,022 temporary) of low-value habitat would be removed or converted in the near-term (CM1, 5,045 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 13,092 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1. However, some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would need to include suitable high-value crop types for loggerhead shrike to avoid the significant impact of habitat loss resulting from CM1. The conservation commitment is 5,684 acres short of meeting the mitigation needed to compensate for other near-term effects on loggerhead shrike high-value habitat. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat* would address the significant impact of near-term high-value habitat loss by providing crop management requirements for CM1 compensation and requiring additional acreage compensation for the other near-term effects.

With the acres of habitat protection and restoration described above, in addition to Mitigation Measure BIO-138, *Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat*, Alternative 1C would not result in a substantial adverse effect through loss of high-value habitat. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential substantial impact from the loss of low-value loggerhead shrike foraging habitat. In addition, AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid potentially significant impacts on nesting individuals. With these measures in place, Alternative 1C would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 1C would have a less-than-significant impact on loggerhead shrike.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 33,688 acres of high-value loggerhead shrike habitat during the term of the Plan. In addition, 23,244 acres of low-value loggerhead shrike habitat would be impacted. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on loggerhead shrike.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-138: Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat

Because the BDCP does not include acreage commitments for the protection of crop types in the near-term time period, DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa as high-value loggerhead shrike habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on loggerhead shrike.

CEQA Conclusion: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 1C would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of Plan Implementation on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. If loggerhead shrike were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting loggerhead shrike. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect loggerhead shrike in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

***NEPA Effects*:** Indirect effects on loggerhead shrike as a result of Plan implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. The loggerhead shrike is not a covered species under the BDCP and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:** Indirect effects as a result of Alternative 1C implementation could have a significant impact on loggerhead shrike. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See discussion of Mitigation Measure BIO-75 under Impact 75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 2,121–4,318 acres of modeled loggerhead shrike habitat (consisting of approximately 894–2,460 acres of high-value habitat; Table 12-1C-51).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 7,845 acres of modeled habitat (Table 12-1C-51), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on the species.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on loggerhead shrike because inundation is expected to occur prior to the breeding season.

Song Sparrow "Modesto" Population

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on Modesto song sparrow. The Modesto song sparrow is common and ubiquitous throughout the study area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-1C-52. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit Modesto song sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)
- Create 500 acres of managed wetlands in CZ 3, 4, 5, or 6 (Objectives GSHC1.3 and GSHC1.4, associated with CM10).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-52. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	43	43	239	239	NA	NA
Total Impacts CM1		**43**	**43**	**239**	**239**	**NA**	**NA**
CM2–CM18	Nesting	1,980	2,816	133	169	81–158	284
Total Impacts CM2–CM18		**1,980**	**2,816**	**133**	**169**	**81–158**	**284**
TOTAL IMPACTS		**2,023**	**2,859**	**372**	**408**	**81–158**	**284**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 3,267 acres of modeled habitat for Modesto song sparrow (2,859 acres of permanent loss and 408 acres of temporary loss, Table 12-1C-52). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 282 acres of modeled Modesto song sparrow habitat (43 acres of permanent loss, 239 acres of temporary loss) from CZ 1, 3, 5, 6, 8, and 9. Impacts would occur from the construction of Intakes 1-5, the construction of the canal and associated borrow and spoil areas, and temporary work areas throughout the central Delta. Permanent and temporary impacts on modeled habitat would also occur as a result of the proposed transmission lines. The CM1 construction footprint overlaps with two Modesto song sparrow occurrences (one with a temporary barge facility and one with the permanent tunnel impact) and the species is ubiquitous throughout the Delta. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on nesting song sparrows. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 143 acres of modeled Modesto song sparrow habitat in the Yolo Bypass in CZ 2. In addition, 133 acres of habitat would be temporarily removed. These losses would occur in the near-term timeframe and primarily consist of valley/foothill riparian natural community and managed wetland. The loss is expected to occur during the first 10 years of Alternative 1C implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated loss of 2,629 acres of modeled Modesto song sparrow habitat.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 80 acres of modeled Modesto song sparrow habitat (44 permanent, 36 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7. The BDCP is expected to restore approximately 5,000 acres of valley/foothill riparian natural community. These lands would be managed as a mosaic of seral stages, age classes, and plant heights, some of which would provide suitable nesting habitat for Modesto song sparrow.
- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP.

Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 2,395 acres of modeled habitat (2,023 permanent, 372 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 282 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,113 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 282 acres of suitable habitat should be restored/created and 282 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,113 acres of modeled habitat, and therefore require 2,113 acres of restoration/creation and 2,113 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 3,267 acres (2,859 acres of permanent loss, 408 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

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NEPA Effects: The loss of Modesto song sparrow habitat and potential for mortality of this special-status species under Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss on Modesto song sparrow under Alternative 1C would not be adverse. The Modesto song sparrow is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 2,395 acres of modeled habitat (2,023 acres permanently, 372 acres temporarily) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 282 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,113 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 282 acres of suitable habitat should be restored/created and 282 acres should be protected to compensate for the CM1 losses of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,113 acres of modeled habitat, and therefore require 2,113 acres of restoration/creation and 2,113 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding a significant impact of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

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The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 1C as a whole would result in the permanent loss of and temporary effects on 3,267 acres (2,859 acres of permanent loss, 408 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to minimize direct mortality of individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

NEPA Effects**:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

CEQA Conclusion**:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow population.

Impact BIO-144: Indirect Effects of Plan Implementation on Modesto Song Sparrow

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 including *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on Modesto song sparrow.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Modesto song sparrow.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Modesto song sparrow from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 1C water conveyance facilities could adversely affect individuals in the absence of other conservation actions. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would minimize this adverse effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Modesto song sparrow, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Indirect effects on Modesto song sparrow as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 81-158 acres of modeled Modesto song sparrow habitat. However, inundation would occur during the nonbreeding season. Reduced foraging habitat availability would be expected during the fledgling period of the nesting season due to periodic inundation.

Based on hypothetical floodplain restoration, construction of setback levees from seasonally inundated floodplain restoration (CM5) could result in periodic inundation of up to approximately 284 acres of Modesto song sparrow modeled habitat (Table 12-1C-52).

The periodic inundation of the Yolo Bypass (CM2) and of seasonal floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat, but may reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).

NEPA Effects: Periodic inundation would not result in an adverse effect on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

CEQA Conclusion: Periodic inundation would have a less-than-significant impact on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

Bank Swallow

This section describes the effects of Alternative 1C, including construction and implementation of other conservation components, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70-90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Construction and restoration associated with Alternative 1C conservation measures would not result in the direct loss of modeled habitat for bank swallow (Table 12-1C-53). However, indirect effects of noise and visual disturbance from *CM2 Yolo Bypass Fisheries Enhancements* and *CM4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat. As explained below, impacts on bank swallow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-1C-53. Changes in Bank Swallow Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Breeding	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities from *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in in CZ 2 and CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

NEPA Effects: Construction activities associated with habitat restoration could adversely affect bank swallow colonies. Noise and visual disturbances could result in adverse effects on bank swallows if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this adverse effect.

CEQA Conclusion: Construction activities associated with habitat restoration could result in a significant impact on bank swallow colonies. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, BDCP proponents will not construct conservation components during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWR will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization.

Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows that are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after March when the swallows have nested and layed eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses, which resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento River (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Chapter 5, Section 5.3.1, *Methods for Analysis*, for a description of the model). Alternative 1C would implement Operational Scenario A, which is the same operational scenario as Alternative 1A described below.

On the Sacramento River, mean monthly flows under Alternative 1A could increase between April and August in all but wet years at the Keswick flow gauge based on modeling assumptions (Table 1 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) and in dry and critical years at the gauge upstream of Red Bluff (Table 3 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) which could lead to inundation of active colonies. However, model outputs indicate that the flows under Existing Conditions and the predicted flows in the late long-term without the project (NAA) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (Table 15 in Section 11C.1.1 and Table 17 in Section 11C.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). In addition, on the Sacramento River at the Verona gauge in average, above normal, and wet water years, flows are predicted to be greater than 14,000 cfs during some months of the breeding season, which could lead to bank collapse events (Tables 1, 3, and 7 in Section 11C1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). However, flows of this height are recorded under Existing Conditions at this flow gauge and are also predicted for the late long-term time without the project (NAA).

NEPA Effects: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1C would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

CEQA Conclusion: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 1C would not differ substantially from those under the Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitor ing[1] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would result inloss of active nest sites or degradation of available nesting habitat, and the extent to

[1] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 1C, including water conveyance facilities construction and implementation of other conservation components, on yellow-headed blackbird. The habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-1C-54. Full implementation of Alternative 1C would include the following biological objectives over the term of the BDCP which would also benefit yellow-headed blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objective ASWNC1.1, Objective VPNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat (Table 12-1C-38) in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.3, associated with CM3).

- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and the implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-54. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 1C

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	3	3	152	152	NA	NA
	Foraging	2,756	2,756	3,634	3,634	NA	NA
Total Impacts CM1		**2,759**	**2,759**	**3,786**	**3,786**	**NA**	**NA**
CM2–CM18	Nesting	5,814	13,902	45	46	961–2,678	18
	Foraging	5,612	26,673	376	905	368–1,476	2,701
Total Impacts CM2–CM18		**11,426**	**40,575**	**421**	**951**	**1,495-4,394**	**2,719**
Total Nesting		**5,817**	**13,905**	**197**	**198**	**961–2,678**	**18**
Total Foraging		**8,368**	**29,429**	**4,010**	**4,539**	**368–1,476**	**2,701**
TOTAL IMPACTS		**4,185**	**43,334**	**4,207**	**4,737**	**1,495-4,394**	**2,719**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 48,071 acres of modeled habitat (14,103 acres of nesting habitat and 33,968 acres of foraging habitat) for yellow-headed blackbird (Table 12-1C-54). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C water conveyance facilities would result in the combined permanent and temporary loss of up to 155 acres of yellow-headed blackbird nesting habitat (3 acres of permanent loss and 152 acres of temporary loss). In addition, 6,390 acres of foraging habitat would be removed (2,756 acres of permanent loss, 3,634 acres of temporary loss, Table 12-1C-54). Activities that would impact suitable yellow-headed blackbird habitat consist of the western channel, tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines in CZ 1, 3, 5, 6, 8, and 9. The largest losses of foraging habitat would occur from loss of corn. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for CM1. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the permanent removal of 29 acres of breeding habitat and 113 acres of nonbreeding habitat for yellow-headed blackbird. In addition, CM2 would result in the temporary loss of 43 acres of breeding habitat for the species. Impacts from CM2 would primarily occur in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation from CM4 would permanently remove or convert an estimated 4,801 acres of breeding habitat. In addition, 3,282 acres of non-breeding habitat would be lost or converted as a result of tidal restoration. However, the resulting 65,000 acres of tidal natural communities would also provide habitat for the species, 24,000 acres of which would be tidal freshwater natural communities providing breeding habitat for yellow-headed blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration* and *CM7 Riparian Natural Community Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would permanently and temporarily remove approximately 2,477 acres of suitable yellow-headed blackbird habitat consisting of 2 acres of breeding habitat and 2,475 acres of nonbreeding habitat.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 230 acres of yellow-headed blackbird agricultural foraging habitat to grassland foraging habitat in CZs 1, 8, and/or 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of yellow-headed blackbird foraging habitat value. CM8 would result in the restoration of 2,000 acres of grassland foraging habitat in the Plan Area.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 133 acres of cultivated lands foraging habitat to nontidal marsh in CZ 2 and CZ 4. Yellow-headed blackbird nesting habitat may develop along the margins of restored nontidal marsh and restoration would also provide foraging habitat for the species.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment.

  If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 6,014 acres (5,817 acres of permanent loss, 197 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 155 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 12,378 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 6,390 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 155 acres of nesting habitat should be restored/created and 155 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 6,390 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 14,103 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 33,968 acres of foraging habitat (10% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (BDCP Chapter 3, Table 3.3-6). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of yellow-headed blackbird habitat and potential for direct mortality of this special-status species associated with Alternative 1C would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM8, CM10, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction phase, the effects of habitat loss on yellow-headed blackbird would not be adverse under Alternative 1C. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 1C would remove 6,014 acres (5,817 acres of permanent loss, 197 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 155 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 12,378 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 6,390 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8*

Grassland Natural Community Restoration, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 155 acres of nesting habitat should be restored/created and 155 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 6,390 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce potential impacts on nesting yellow-headed blackbird to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 14,103 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 33,968 acres of foraging habitat (10% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (BDCP Chapter 3, Table 3.3-6). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 1C's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts necessary to compensate for habitat lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would reduce the potential for yellow-headed blackbird collision with transmission lines. Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 1C would not result in an adverse effect on yellow-headed blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 1C would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of Plan Implementation on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 1C restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-headed blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-headed blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury, in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area.

Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: In the absence of other conservation actions, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 1C would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Indirect effects of plan implementation would represent an adverse effect on yellow-headed blackbird in the absence of other conservation measures. This would be a significant impact. With AMM1-AMM7, AMM27, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of plan implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 961–2,678 acres of nesting habitat and 368–2,678 acres of foraging habitat (Table 12-1C-54). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 18 acres of nesting habitat and 2,701 acres of nonbreeding habitat (Table 12-1C-54) resulting in the temporary loss of these habitats. Foraging yellow-headed blackbirds would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would not have an adverse effect on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat may be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and, although foraging habitat would be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the second naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-1C-55. Full implementation of Alternative 1C would also include biological objectives over the term of the BDCP to benefit the riparian brush rabbit (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian brush rabbit, with conservation principles involves protecting, restoring or creating, and maintaining habitat and corridors near the largest remaining fragments of habitat and extant populations; providing high-water refugia from flooding; and managing feral predators (dogs and cats) in areas occupied by the species. The conservation measures that will be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5, CM7, and CM11).
- Of the 750 acres of protected valley/foothill riparian natural community protected under Objective VFRNC1.2, protect at least 200 acres of suitable riparian brush rabbit habitat (defined in CM7 Riparian Natural Community Restoration) that is occupied by the species or contiguous with occupied habitat (Objective RBR1.1, associated with 3).
- Of the 1,000 acres of early- to midsuccessional riparian habitat maintained under VFRNC2.2, maintain at least 800 acres within the range of the riparian brush rabbit (CZ 7), in areas that are adjacent to or that facilitate connectivity with occupied or potentially occupied habitat (Objective RBR1.2, associated with CM3, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain at least 300 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Objective 1.3, associated with CM3, CM7, and CM11).
- Create and maintain high-water refugia in the 300 acres of restored riparian brush rabbit habitat and the 200 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Objective RBR1.4, associated with CM7 and CM11).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Objective RBR1.5, associated with CM11).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres of grasslands restored under Objective GNC1.2, protect or restore grasslands on the landward side

of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6m associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-55. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	0	0	4	4	NA	NA
	Grassland	41	41	39	39	NA	NA
Total Impacts CM1		**41**	**41**	**43**	**43**	**NA**	**NA**
CM2–CM18	Riparian	0	62	0	35	0	264
	Grassland	0	44	0	20	0	423
Total Impacts CM2–CM18		**0**	**106**	**0**	**55**	**0**	**687**
TOTAL IMPACTS		**41**	**147**	**43**	**98**	**0**	**687**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 1C conservation measures would result in the permanent and temporary losses combined of up to 101 acres of riparian habitat and 144 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-1C-55). The hypothetical footprint for levee construction under CM5, overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange. Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 1C water conveyance facilities would result in the permanent removal of approximately 13,741 acres of associated grassland habitat and in the temporary removal of 4 acres of riparian habitat and 39 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-1C-55). The riparian habitat that would be removed is of low value for the riparian brush rabbit as is consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 19 acres of riparian habitat and 18 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. The riparian habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by agricultural lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. The habitat that would be removed is not adjacent to any existing conserved lands, and is several miles north and northeast of the northernmost riparian brush rabbit record located northeast of Paradise Cut (Williams et al. 2002). Although the final footprint for tidal natural communities restoration would differ from the hypothetical footprint, compliance monitoring would be implemented to ensure that acreage limits are not exceeded and the measures described in AMM25 *Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian brush rabbit.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 43 acres of riparian habitat and 26 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late longterm. Levee construction would also result in the temporary removal of 35 acre riparian habitat and 20 acres of grassland habitat for the riparian brush rabbit. Although the effects are considered temporary, five years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected. The value of this habitat for riparian brush rabbit is high: although it consists of small patches and narrow bands of riparian vegetation, these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange.

  Although the final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis, restoration of the river floodplain in CZ 7 would be targeted in the general area of the riparian brush rabbit population. Implementation of adaptive management described in AMM25 would ensure that riparian brush rabbit habitat permanently removed does not exceed maximum allowable habitat loss for this species.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37 Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.

Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: Ongoing maintenance of BDCP facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.
- Recreation: Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, AMM37, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.
- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbits because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian brush rabbit because tidal natural communities restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian brush rabbits: however, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction (AMM25).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 1C would result in permanent and temporary effects combined on 4 acres of riparian habitat and 41 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would be in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 4 acres of riparian habitat should be restored, 4 acres of riparian habitat should be protected, and 82 acres of grassland should be protected for riparian brush rabbit for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1 and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1-RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 4 acres of riparian habitat restored and protected, and 82 acres of grassland protected.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM*6 *Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, and *AMM37 Recreation.* These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6.012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1C as a whole would result in permanent and temporary effects combined on 101 acres of modeled riparian habitat and 144 acres of modeled grassland habitat for riparian brush rabbit in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, Alternative 1C would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain will be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains will transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas will provide refuge for the riparian brush rabbit during most years. Alternative 1C would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

NEPA Effects: In the near-term, the loss of riparian brush rabbit habitat under Alternative 1C would not be an adverse effect because there is little likelihood of riparian brush rabbits being present and because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of riparian brush rabbit riparian and grassland habitat associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the effects of Alternative 1C as a whole on riparian brush rabbit would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 1C would result in permanent and temporary effects combined on 4 acres of riparian habitat and 41 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. All the near-term loss of riparian brush rabbit habitat would be in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical CEQA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 4 acres of riparian habitat should be restored, 4 acres of riparian habitat should be protected, and 82 acres of grassland should be protected for riparian brush rabbit for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RBR1.1-RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1C would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 8 acres or riparian habitat protected, 8 acres of riparian habitat restored, and 360 acres of grassland habitat

The plan also contains commitments to implement AMM1–AMM7, AMM10, AMM25, and AMM37. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 1C would result in permanent and temporary effects combined on 101 acres of modeled riparian habitat and 144 acres of modeled grassland habitat for riparian brush rabbit in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain will be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains will transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas will provide refuge for the riparian brush rabbit during most years. The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

Only a small proportion of the habitat losses would be considered occupied and of high value. Alternative 1C conservation measures provide for large acreages of riparian brush rabbit riparian and grassland habitat to be protected and restored, and the BDCP includes AMM1–AMM7, AMM10, AMM25, and AMM37 directed at minimizing or avoiding potential impacts during construction and operation of the conservation measures. Overall, Alternative 1C would provide a substantial net benefit to the riparian brush rabbit through the increase in available habitat and habitat in protected status.

Considering the habitat restoration and protection associated with CM3, CM7, CM8 and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the temporary and permanent losses of riparian and grassland habitat and potential direct mortality of riparian brush rabbit as a result of implementing Alternative 1C would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. The loss of habitat and potential mortality of riparian brush rabbits would be a less-than-significant impact under CEQA.

Impact BIO-153: Indirect Effects of Plan Implementation on Riparian Brush Rabbit

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat in the study area. These construction activities would include water conveyance (including transmission line) construction in CZ 8, tidal natural community restoration construction, and construction of setback levees. Water conveyance construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. Tidal natural communities restoration construction would also potentially affect adjacent riparian habitat and associated grassland habitat for this species: however, adverse effects on the species are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian brush rabbit. The activity most likely to result in noise, lighting, and visual disturbances to riparian brush rabbit is the construction of setback levees for floodplain restoration, which would take place in CZ 7, where the species is known to occur. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1C would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 1C would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise, lighting, and visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 1C, the BDCP would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 1C would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian brush rabbit habitat. This activity would periodically inundate approximately 264 acres of riparian habitat (9% of riparian habitat in the Plan Area) and 423 acres of associated grassland habitat (14% of associated grassland habitat in the Plan Area) for the riparian brush rabbit. The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of high-value habitat for the species: although they consist of small patches and narrow bands of riparian vegetation, many of these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The restored floodplain would include a range of elevations from lower lying areas that flood frequently (e.g., every 1 to 2 years) to higher elevation areas that flood infrequently (e.g., every 10 years or more).

Seasonal flooding in restored floodplains can result in injury or mortality of individuals if riparian brush rabbits occupy these areas and cannot escape flood waters. One recorded occurrence of riparian brush rabbit (Williams et al. 2002), just west of Stewart Road in Mossdale, is in the area that would be seasonally flooded based on the hypothetical restoration footprint.

NEPA Effects: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1C, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, Alternative 1C would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The overall effect of seasonal inundation on existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for covered riparian species, such as the riparian brush rabbit. Long-term management of riparian areas would ensure that refugia also exist along the edges of seasonally inundated habitat.

The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 1C, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Periodic inundation of riparian and grassland habitat for riparian brush rabbit under Alternative 1C would have a less-than-significant impact on the species.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the BDCP area in CZ 7, south of SR 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47).

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of riparian woodrat modeled habitat as indicated in Table 12-1C-56. Tidal habitat restoration, floodplain restoration, and protection and management of natural communities could affect modeled riparian woodrat habitat. However, because the species is not known to occur in the study area it is not expected to be affected by BDCP actions unless the species were to establish in the study area over the term of the BDCP. Full implementation of Alternative 1C would also include biological objectives over the term of the BDCP to benefit the riparian woodrat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian woodrat involves providing opportunities for population expansion into the Plan Area from adjacent lands to the south and southeast. The strategy focuses on restoring and maintaining suitable habitat at the southernmost end of CZ 7, providing connectivity with existing populations to the south and southeast, and creating and maintaining flood refugia. This conservation approach is consistent with the recovery plan (U.S. Fish and Wildlife Service 1998) and conservation principles (BDCP Appendix 3.E). The conservation measures that will be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM5, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain 300 acres riparian habitat in CZ 7 that meets the ecological requirements of the riparian woodrat (i.e., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat (Objective RW1.1, associated with CM3, CM7, CM11).
- Provide and maintain high-water refugia in the 300 acres of riparian woodrat habitat restored under Objective RW1.1 through the retention, construction, and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 67 feet (Objective RW1.2, associated with CM7 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian woodrat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-56. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	0	0	1	1	NA	NA
Total Impacts CM1		**0**	**0**	**1**	**1**	**NA**	**NA**
CM2–CM18	Riparian	0	51	0	33	0	203
Total Impacts CM2–CM18		**0**	**51**	**0**	**33**	**0**	**203**
TOTAL IMPACTS		**0**	**51**	**1**	**34**	**0**	**203**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

Alternative 1C conservation measures would result in the permanent loss of up to 51 acres of habitat and temporary loss of up to 34 acres of habitat for riparian woodrat (Table 12-1C-56). Construction of Alternative 1C water conveyance facilities (CM1), tidal natural communities restoration and seasonally inundated floodplain restoration would remove habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 1C water conveyance facilities would result in the temporary removal of 1 acre of modeled habitat for the riparian woodrat in CZ 9 (Table 12-1C-56). The modeled habitat that would be removed is of low value for the riparian woodrat as is consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. Trapping efforts conducted for the riparian woodrat in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled habitat for the riparian woodrat in CZ 7. This habitat is of low value, consisting of a small, isolated patch surrounded by agricultural lands, and the species has a relatively low likelihood of being present in these areas. The measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian woodrat. Because the estimates of habitat loss due to tidal inundation are based on projections of where restoration may occur, actual habitat loss is expected to be lower because sites would be selected to minimize effects on riparian woodrat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 41 acres of modeled habitat for the riparian woodrat in CZ 7. The value of this habitat for riparian woodrat is moderate. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River. There are two species occurrences immediately south of CZ 7, one of which is less than 1.5 mile from the southernmost patch of riparian habitat potentially affected by levee construction.

  The final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis. However, monitoring and adaptive management described in *CM11 Natural Communities Enhancement and Management a*nd AMM25 would ensure that modeled habitat permanently removed as a result of floodplain restoration does not exceed the amount estimated based on the hypothetical footprint. Habitat loss is expected to be lower than 41 acres because sites would be selected and restoration designed to minimize effects on the riparian woodrat. If natural flooding is insufficient to maintain appropriate riparian woodrat vegetation structure, the vegetation would be actively managed to provide suitable habitat structure as described in *CM11 Natural Communities Enhancement and Management.*

  Levee construction would also result in the temporary removal of 33 acres of modeled habitat for the riparian woodrat. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian woodrat habitat. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian woodrat habitat and are expected to result in overall improvements to and maintenance of riparian woodrat habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: The only ongoing effects on the riparian woodrat are those potentially resulting from habitat enhancement and management activities. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities may result in harassment of riparian woodrats through noise and visual disturbance which would be minimized with implementation of AMM1–AMM7, AMM10, and AMM25.
- Injury and direct mortality: Water conveyance facility construction is not likely to result in injury or mortality of individual riparian woodrats because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian woodrats because tidal natural communities restoration projects would be designed to avoid occupied riparian woodrat habitat and if that is not possible to trap and relocate the species (AMM25). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats: however, preconstruction surveys, construction monitoring, and other measures would be implemented under AMM25 to avoid and minimize injury or mortality of this species during construction, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. If occupied riparian woodrat habitat cannot be avoided, mortality would be avoided through implementation of a trapping and relocation program. The program will be developed in coordination with USFWS, and relocation will be to a site approved by USFWS prior to construction activities.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 1C would result in temporary effects on 1 acre of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction in CZ 9, and would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the

BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 1 acre of riparian habitat should be restored and 1 acre of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would not be adverse under NEPA, because only 1 acre of modeled habitat would be temporarily affected and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 1C as a whole would result in the permanent loss of and temporary removal of 85 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (*CM3*) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 1C conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

***NEPA Effects*:** Alternative 1C would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have an adverse effect on riparian woodrat under Alternative 1C.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 1C would result in temporary effects on 1 acre of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction in CZ 9, and would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical CEQA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 1 acre of riparian habitat should be restored and 1 acre of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1C would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 1 acre of riparian habitat protected and 1 acre of riparian habitat restored.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would not be significant under CEQA, because only 1 acre of modeled habitat would be temporarily affected and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to AMM1–AMM7, AMM10, and AMM25. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 1C as a whole would result in the permanent loss of and temporary removal of 85 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (*CM3*) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area. Implementation of Alternative 1C conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

Alternative 1C would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have a significant impact on riparian woodrat.

Impact BIO-156: Indirect Effects of Plan Implementation on Riparian Woodrat

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled habitat for riparian woodrat. These effects are related construction activities associated with water conveyance construction, tidal natural communities restoration construction, and construction of setback levees. Indirect effects on the species from construction associated with tidal natural communities restoration are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian woodrat. The activity most likely to result in noise, lighting, and visual disturbance to riparian woodrat is the construction of setback levees.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1C would avoid the potential for substantial adverse effects on riparian woodrats, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Therefore, indirect effects of Alternative 1C would not have an adverse effect on riparian woodrat

CEQA Conclusion: Should the species be detected in the study area, indirect effects of conservation measure construction and implementation could impact riparian woodrat and its habitat. AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian woodrat habitat. Floodplain restoration would result in periodic inundation of up to 203 acres of riparian woodrat habitat (9% of the riparian woodrat habitat in the Plan Area). The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of moderate-value habitat for the species. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River and there are two species occurrences immediately south of CZ 7, one of which is less than 1 mile from the southernmost patch of riparian habitat potentially affected by levee construction. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more).

NEPA Effects: Alternative 1C's periodic inundation of 203 acres of riparian habitat for riparian woodrat is not expected to result in substantial adverse effects on riparian woodrat, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrat. The effects of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation. Therefore, the periodic inundation of riparian woodrat habitat would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect a total of 203 acres of riparian habitat for riparian woodrat, representing 9% of the 2,166 acres of modeled riparian woodrat habitat in the study area. The impact of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation, as described in AMM25. Implementation of CM5 would not be expected to result in significant impacts on riparian woodrat, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Periodic inundation of riparian woodrat habitat under Alternative 1C would have a less-than-significant impact.

Salt Marsh Harvest Mouse

The habitat model used to assess effects on the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Construction and restoration associated with Alternative 1C conservation measures would result in effects on modeled salt marsh harvest mouse habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-1C-57. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit salt marsh harvest mouse (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary salt marsh harvest mouse habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect and enhance at least 1,500 acres of managed wetland in Grizzly Island Marsh Complex for the benefit of salt marsh harvest mouse (Objective MWNC1.1, associated with CM3).
- Protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3 and CM8).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of restored or created middle and high marsh as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective SMHM1.1).

- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of managed wetland protected and enhanced in the Grizzly Island Marsh Complex as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California, and increase population levels above the current baseline (Objective SMHM1.2).

As explained below, with the restoration and protection of these amounts of habitat, in addition to AMMs to minimize potential effects, impacts on the salt marsh harvest mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-57. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	TBEW Primary	64	67	0	0	0	0
	TBEW Secondary	0	0	0	0	0	0
	Upland Secondary	8	9	0	0	0	0
	MW Wetland Primary	1,913	5,323	0	0	0	0
	MW Wetland Secondary	315	807	0	0	0	0
	MW Upland	165	762	0	0	0	0
Total Impacts CM2–CM18		**2,465**	**6,968**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**2,645**	**6,968**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
TBEW = tidal brackish emergent wetland
MW = managed wetland
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

Alternative 1C tidal restoration (CM4) would be the only conservation measure resulting in effects on salt marsh harvest mouse habitat. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 6,968 acres of salt marsh harvest mouse modeled habitat, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. Salt marsh harvest mouse may be displaced temporarily from areas of converted habitat but these areas would ultimately provide suitable habitat for the species. However, 1,058 of these acres would be downgraded from primary habitat (67 acres of primary tidal brackish emergent wetland and 991 acres of primary managed wetland) to secondary tidal brackish emergent wetland. The hypothetical restoration footprints in Suisun Marsh overlap with 13 CNDDB records for salt marsh harvest mouse (California Department of Fish and Wildlife 2013); however, the BDCP's conservation actions assume that all suitable habitat in Suisun Marsh is occupied by the species.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 1,500 acres of tidal brackish emergent wetland would be managed to provide viable habitat for salt marsh harvest mouse and the protection of 1,500 acres of managed wetland specifically to be managed for salt marsh harvest mouse. A variety of habitat management actions included in CM11 that are designed to enhance and manage these areas for salt marsh harvest mouse and may result in localized ground disturbances that could temporarily remove small amounts of salt marsh harvest mouse habitat. The restoration of tidal brackish emergent wetlands, the protection managed wetlands, and the protection and/or restoration of grasslands within 200 feet of restored salt marsh harvest mouse habitat would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of salt marsh harvest mouse habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to salt marsh harvest mouse during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA and would be less than significant under CEQA. Alternative 1C would effect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be from primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under Alternative 1C would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- Restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs. This phasing would ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level effects on salt marsh harvest mouse resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention*

Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1C as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. These effects (loss and conversion) would be to 20% of the modeled habitat in the study area. Most of these effects (99%) would be to managed wetlands, which though are known to be occupied by salt marsh harvest mouse are at high risk of catastrophic flooding and have a lower long-term conservation value than tidal wetlands (U.S. Fish and Wildlife Service 2010). Effects on up to 20% of the species' habitat in the Plan Area may diminish the salt marsh harvest mouse population in the Plan Area and result in reduced genetic diversity, thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas.

The Plan includes a commitment to restore or create 6,000 acres to tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (Objectives TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4), the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (Objectives SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (Objectives GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh occurs gradually. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh

would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

NEPA Effects: In the absence of other conservation actions, the effects on salt marsh harvest mouse habitat from Alternative 1C in the would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8 and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of salt marsh harvest mouse habitat and potential mortality of individuals under Alternative 1C would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of near-term covered activities would be less than significant. Alternative 1C would impact 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be to primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under Alternative 1C would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- To ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level impacts on salt marsh harvest mouse from CM1, the analysis of the impacts of conservation actions does not include a comparison with standard ratios used for project level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan,* and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 1C as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associate with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (Objectives SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (Objectives GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

Alternative 1C would result in substantial modifications to salt marsh harvest mouse habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5, and AMM26, which would be in place throughout the construction phase, Alternative 1C over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on salt marsh harvest mouse.

Impact BIO-159: Indirect Effects of Plan Implementation on Salt Marsh Harvest Mouse

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to salt marsh harvest mouse occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM6 and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on salt marsh harvest mouse.

Tidal marsh restoration has the potential to increase salt marsh harvests mouse's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High tidal marsh is considered to be primary habitat for salt marsh harvest mouse and thus the species could be exposed to methyl mercury in tidal restoration areas. Salt marsh harvest mouse may be exposed to elemental mercury by feeding on pickleweed, which is found concentrated in the distal tips of pickleweed leaves (Yee et. al., 2008). Though elemental mercury is less bioavailable than methylmercury, studies have shown that mercury can become methylated in the anaerobic portions of the intestinal tract (Rudd et al. 1980, Rieder et al. 2013) and could thus become a pathway for salt marsh harvest exposure to methylmercury. A study of small mammals residing in pickleweed around the San Francisco Bay showed an absence of salt marsh harvest mouse where mercury concentrations measured in house mice (*Mus musculus*) livers were ≥0.19 µg/g (dry weight) (Clark et al. 1992). Clark et al (1992) also report that the lack of salt marsh harvest mouse at these locations are not the result of undetected habitat differences or are by chance. Clarke et al (1992) suggest that the absence of salt marsh harvest mouse at certain locations may be associated with higher amounts of mercury and polychlorinated biphenyls (PCBs); however, because their study didn't analyze contaminants in salt marsh harvest mouse and because (at that time) there was no data in the literature on contaminants in harvest mice, they could not make conclusions on these associations. Currently, it is unknown what the exact exposure pathways are or what tissue concentrations are harmful to the salt marsh harvest mouse.

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for salt marsh harvest mouse exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on salt marsh harvest mouse resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1C would avoid and minimize indirect effects on salt marsh harvest mouse. These AMMs would also avoid and minimize effects that could substantially reduce the number of salt marsh harvest mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on salt marsh harvest mouse.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact salt marsh harvest mouse within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment adjacent to salt marsh harvest mouse habitat could also impact the species. With implementation of AMM1–AMM5, and AMM26 as part of Alternative 1C construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on salt marsh harvest mouse, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse. The indirect effects of Alternative 1C would have a less-than-significant impact on salt marsh harvest mouse.

Salt marsh harvest mouse could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse, and, therefore, would have a less-than-significant impact on the species.

Suisun Shrew

Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model. Construction and restoration associated with Alternative 1C conservation measures would result in effects on modeled Suisun shrew habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-1C-58. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP to benefit Suisun shrew (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary Suisun shrew habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).

Protect or restore grasslands adjacent t restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area, which provides refugia during high tides (Objective GNC1.4, associated with CM3 and CM8).As explained below, with the restoration and protection of these amounts of habitat, impacts on the Suisun shrew would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-58. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	58	60	0	0	0	0
	Secondary	47	342	0	0	0	0
Total Impacts CM2–CM18		**105**	**401**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**105**	**401**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun Shrew

BDCP tidal restoration (CM4) would be the only conservation measure resulting in loss of habitat to Suisun shrew. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 401 acres of Suisun shrew modeled habitat, which would include 377 acres of permanent losses and 24 acres of habitat conversions. Suisun shrew may be displaced temporarily from areas of converted habitat but would ultimately provide suitable habitat for the species. However, all 24 acres would be converted from secondary to primary habitat and therefore over would be a net benefit to the species. The hypothetical restoration footprints overlap with two CNDDB records for Suisun shrew (California Department of Fish and Wildlife 2013).

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, the restoration of at least 6,000 acres of tidal brackish emergent wetland would be managed to provide habitat for covered species, including Suisun shrew. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas may result in localized ground disturbances that could temporarily remove small amounts of Suisun shrew habitat. The areas of grasslands that would be protected and/or restored within 200 feet of restored tidal marsh would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of

nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of Suisun shrew habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to Suisun shrew during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMM described below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. Alternative 1C would effect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area will benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects on Suisun shrew.

Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation

- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

- The amount of tidal habitat restored in the near term (2,000 acres) would greatly exceeds the amount permanently lost (105 acres).

Because there would be no project-level effects on Suisun shrew resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and*

Countermeasure Plan, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1C as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area).

The Plan contains a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

NEPA Effects: In the absence of other conservation actions, the effects on Suisun shrew habitat from Alternative 1C would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, the effects of losses and conversions of Suisun shrew habitat and potential mortality of individuals on Suisun shrew would not be adverse under Alternative 1C.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would be less than significant. Alternative 1C would impact 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These impacts include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 1,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area will benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and impacts on Suisun shrew.

Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there would be no project level impacts on Suisun shrew resulting from CM1, the analysis of the impacts of conservation actions does not include a comparison with standard ratios used for project-level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan,* and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 1C as a whole would result in effects to 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

Alternative 1C would result in substantial modifications to Suisun shrew habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction phase, Alternative 1C over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on Suisun shrew.

Impact BIO-161: Indirect Effects of Plan Implementation on Suisun Shrew

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to Suisun shrew occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect Suisun shrew and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on Suisun shrew.

Tidal marsh restoration has the potential to increase Suisun shrew's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High and mid tidal marsh is considered to be primary habitat for Suisun shrew and thus the species could be exposed to methylmercury in tidal restoration areas. Suisun shrew could be exposed to methylmercury by feeding on marsh invertebrates that may bioaccumulate methylmercury from marsh sediments. Toxic concentrations of methylmercury have been found in the kidneys of shrews that inhabit contaminated sites and forage on earthworms and other prey that live within contaminated sediments (Talmage and Walton 1993; Hinton and Veiga 2002).

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for Suisun shrew exposure to methylmercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on Suisun shrew resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 1C would avoid and minimize the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of Suisun shrew, or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on Suisun shrew.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact Suisun shrew within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact Suisun shrew and its habitat. The inadvertent discharge of sediment adjacent to Suisun shrew habitat could also impact the species. With implementation of AMM1–AMM5, and AMM26 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew. The indirect effects of Alternative 1C would have a less-than-significant impact on Suisun shrew.

Suisun shrew could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew, and, therefore, would have a less-than-significant impact on the species.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10.

The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013).) reports eight occurrences of San Joaquin kit foxes along the extreme western edge of the study area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San

Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-1C-59). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin kit fox habitat and potential American badger habitat. Full implementation of Alternative 1C would also include biological objectives over the term of the BDCP to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the Plan Area; and providing connectivity to habitat outside the Plan Area. The conservation measures that will be implemented to achieve the biological goals and objectives are summarized below.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in CZs 1, CZ 8, and/or CZ 11 (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and CZ 11, primarily in core vernal pool recovery areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in C Z 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration) (Objective VPNC1.2, associated with CM3 and CM9).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.4, associated with CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.4, associated with CM11).

- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.5, associated with CM11).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-59. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	193	193	160	160	NA	NA
Total Impacts CM1		**193**	**193**	**160**	**160**	**NA**	**NA**
CM2–CM18	Grassland	3	8	0	0	0	0
Total Impacts CM2–CM18		**3**	**8**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**196**	**201**	**160**	**160**	**0**	**0**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 1C conservation measures would result in the permanent and temporary loss combined of up to 353 acres of modeled habitat for the San Joaquin kit fox (Table 12-1C-59). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects on are anticipated to be the same as those described for San Joaquin kit fox. There are two San Joaquin kit fox and no American badger occurrences that overlap with the Plan footprint.

Habitat enhancement and management activities (CM11) could result in local adverse effects on species. In addition, construction vehicle activity could cause injury or mortality of San Joaquin kit foxes and badgers. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 193 acres and the temporary loss of 160 acres of modeled San Joaquin kit fox habitat and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8.

- *CM11 Natural Communities Enhancement and Managemen*t: The creation of recreational trails and recreational staging areas would result in the permanent removal of 8 acres of San Joaquin kit fox modeled habitat and American badger potential habitat. *AMM24 San Joaquin Kit Fox* would be implemented to ensure that San Joaquin kit fox dens are avoided, as described in BDCP Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Mitigation Measure BIO-162*: Conduct Preconstruction Survey for American Badger* would be implemented to ensure that American badger dens are avoided.

  Passive recreation in the reserve system could result in disturbance of San Joaquin kit foxes and American badgers at their den site. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox and American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox or American badger populations. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

  The BDCP would require the enhancement and management of these protected existing grasslands and restored grasslands to improve their function as a natural community of plants and wildlife and for associated covered species, including San Joaquin kit fox and American badger. The BDCP also includes actions to improve rodent prey availability.

  However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs and Mitigation Measures listed below. These AMMs and Mitigation Measures would remain in effect throughout the BDCP's construction phase.

- Operations and maintenance: Ongoing maintenance of BDCP facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, and AMM24 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Under Alternative 1C there would be a loss of 356 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (353 acres) and CM11 (3 acres).

Typical NEPA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 712 acres of grassland should be protected for San Joaquin kit fox to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 712 acres of grassland protected.

The effects on San Joaquin kit fox and American badger habitat from Alternative 1C as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the effects of Alternative 1C would be not be adverse with habitat protection, restoration, and management and enhancement in addition to implementation of *AMM1 Worker Training Awareness*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 361 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing 7% of the modeled habitat (Table 12-1C-59).

With full implementation of Alternative 1C, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration will likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for both species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1)and to other adjoining San Joaquin kit fox habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badgers, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (see BDCP Appendix 2.A). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, and Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

NEPA Effects: In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1C would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, the effects of Alternative 1C as a whole on San Joaquin kit fox and American badger would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA.

Under Alternative 1C there would be a loss of 356 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (353 acres) and CM11 (3 acres).

Typical CEQA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 712 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 712 acres of grassland protected.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM24, and AMM37 which include elements that avoid or minimize the risk of construction activity impacting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 1C on San Joaquin kit fox and American badger would be less than significant under CEQA, because the number of acres required to meet the typical rations described above would be only 712 acres of grassland protected.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 361 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing 7% of the modeled habitat (Table 12-1C-59).

With full implementation of Alternative 1C, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger are most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration will likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for the species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1) and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badgers, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (see BDCP Appendix 2.A). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, and Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 1C would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 1C as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project-related conservation areas within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Plan Implementation on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facility, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, if any, and other measures as described in AMM24 and MM BIO-62.

NEPA Effects: Implementation of the AMMs listed above and Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*, would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on San Joaquin kit fox or American badger.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. In addition, Mitigation Measure BIO-162 would reduce the impact of indirect effects of Alternative 1C on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

Habitat for San Joaquin pocket mouse consists of the grassland natural community throughout the Plan Area. The species requires friable soils for burrowing. Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-1C-60. Full implementation of Alternative 1C would also include the following conservation actions over the term of the BDCP that would likely benefit San Joaquin pocket mouse.

- Protect 8,000 acres of grasslands (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grasslands (Objective GNC1.2, associated with CM8).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (Objective GNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-60. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 1C (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Grassland	358	358	320	320	NA	NA
Total Impacts CM1		**358**	**358**	**320**	**320**	**NA**	**NA**
CM2–CM18	Grassland	889	2,056	239	274	385–1277	514
Total Impacts CM2–CM18		**889**	**2,056**	**239**	**274**	**385–1277**	**514**
TOTAL IMPACTS		**1,247**	**2,414**	**559**	**594**	**385–1277**	**514**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 1C conservation measures would result in the combined permanent and temporary loss of up to 3,008 acres of habitat for San Joaquin pocket mouse (of which 2,414 acres would be a permanent loss and 594 acres would be a temporary loss of habitat, Table 12-1C-60). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool Natural Community and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, *CM11 Natural Community Enhancement and Management*, and *CM18 Conservation Hatcheries*. The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the combined permanent and temporary loss of up to 678 acres of potential San Joaquin pocket mouse habitat (358 acres of permanent loss, 320 acres of temporary loss) in CZ 3-CZ 6, CZ 8, and CZ 9. The majority of grassland that would be removed would be in CZ 8 and CZ 9, from the construction of the new canals. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 1C construction locations. Construction of the canal south of Clifton Court Forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Game 2012).

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 388 acres of potential San Joaquin pocket mouse habitat in the Yolo Bypass in CZ 2. In addition, 239 acres would be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 1,122 acres of potential San Joaquin pocket mouse habitat. The majority of the losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment remaining grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 85 acres of San Joaquin pocket mouse habitat (51 permanent, 34 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration will impact 410 acres of grasslands, primarily in CZ 7, as part of tidal natural communities restoration (11 acres) and seasonal floodplain restoration (399 acres).
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Up to 10 acres of grassland will be permanently converted to vernal pool complex. The vernal pool and alkali seasonal wetland restoration will leave intact the grasslands surrounding the vernal pools. Temporary construction-related disturbance of grassland habitat would result from implementation of *CM9* in CZ 1, CZ 8, and CZ 11. However, all areas would be restored to their original or higher value habitat after the construction periods.
- *CM11 Natural Communities Enhancement and Management*: The creation of recreational trails and recreational staging areas will result in the permanent removal of 50 acres of grassland. The protection of 8,000 acres of grassland for covered species is also expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.

A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. With full implementation of the BDCP, enhancement and management actions designed for western burrowing owl would also be expected to benefit these species. San Joaquin pocket mouse would benefit particularly from protection of grassland habitat against potential loss or degradation that otherwise could occur with future changes in existing land use.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of San Joaquin pocket mouse habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 1C would remove 1,806 acres of San Joaquin pocket mouse habitat (1,247 permanent, 559 temporary) in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new canal south of the forebay. These effects would result from the construction of the water conveyance facilities (CM1, 678 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Grassland Natural Community Restoration [CM8], Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], and Conservation Hatcheries [CM18] 1,128 acres).

The typical NEPA project-level mitigation ratio for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using this ratio would indicate that 1,356 acres of grassland natural communities should be protected to mitigate the CM1 losses of 678 acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, especially considering that a large portion of the affected grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 1C as a whole would result in the permanent loss of and temporary effects on 3,008 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8 and CZ 11 (GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area)(GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (GNC1.2) will improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

***NEPA Effects*:** In the near-term, the loss of San Joaquin pocket mouse habitat and potential direct mortality would not be an adverse effect because the BDCP has committed to protecting and restoring an acreage that would meet the typical mitigation ratios described above. In the absence of other conservation actions, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 1C would represent an adverse effect. However, the BDCP has committed to habitat protection and restoration associated with CM3, CM8, and CM11. This habitat protection and restoration would be guided by biological goals and objectives and by AMM1–AMM6, and AMM10, which would be in place throughout the construction period. Considering these commitments, losses of San Joaquin pocket mouse habitat and potential mortality under Alternative 1C would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 1C would remove 1,806 acres of modeled (1,247 permanent, 559 temporary) habitat for San Joaquin pocket mouse in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new canal south of the forebay. These impacts would result from the construction of the water conveyance facilities (CM1, 678 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Grassland Natural Community Restoration [CM8], Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], and Conservation Hatcheries [CM18] 1,128 acres).

Typical CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,356 acres of grassland natural communities should be protected to mitigate the CM1 losses of 678 acres of San Joaquin pocket mouse habitat. The near-term impacts of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratios (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under CM11 Natural Communities Enhancement and Management, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, especially considering that a large portion of the impacted grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 1C would be less than significant under CEQA.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 1C as a whole would result in the permanent loss of and temporary impacts on 3,008 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8 and CZ 11(GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area)(GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (GNC1.2) will improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under CM11.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM6, and AMM10, the loss of habitat and direct mortality through implementation of Alternative 1C would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Impact BIO-165: Indirect Effects of Plan Implementation on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat over the term of the BDCP. These potential effects would be minimized and avoided through AMM1–AMM6 and AMM10, which would be in effect throughout the plan's construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

NEPA Effects: Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on San Joaquin pocket mouse.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6 and AMM10 as part of Alternative 1C construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, for details on methods and results).

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (Table 12A-2 in Appendix 12A). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, for details on methods and results).

The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat, at the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Construction and restoration associated with Alternative 1C conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-1C-61. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. The conservation measures that would be implemented to achieve the biological goals and objectives that would also benefit special-status bats are summarized below.

- Protect or restore 142,200 acres of high-value natural communities (Objective L1.1, associated with CM3). This objective includes restoring and protecting a variety of habitat types described below (BDCP Chapter 3, Table 3.3-4).
    - Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
    - Protect 600 acres of existing vernal pool complex (Objective VPNC1.1, associated with CM3).
    - Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
    - Protect 8,100 acres of managed wetland (Objective MWNC1.1, associated with CM3 and CM11).
    - Protect 48,625 acres of cultivated lands (Objective CLNC1.1, associated with CM3 and CM11).
    - Protect, restore, or create 2,740 acres of rice land or equivalent habitat type for the giant garter snake (Objective GGS3.1, associated with CM3, CM4, and CM10).
    - Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and 8).
    - Restore 67 acres of vernal pool complex (Objective VPNC1.2, associated with CM3 and 9).
    - Restore and protect 65,000 acres of tidal natural communities (Objective L1.2, associated with CM2, 3, and 4).
    - Restore or create 5,000 acres of valley/foothill riparian natural community (Objective VFRNC1.1, associated with CM3 and CM7).
    - Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-1C-61. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 1C [a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Roosting	135	135	333	333	NA	NA
	Foraging	6,832	6,832	10,451	10,451	NA	NA
Total Impacts CM1		**6,967**	**6,967**	**10,784**	**10,784**	**NA**	**NA**
CM2–CM18	Roosting	524	1,570	167	212	324	411
	Foraging	14,497	60,399	773	2,126	21,265	10,137
Total Impacts CM2–CM18		**15,021**	**61,969**	**940**	**2,338**	**21,589**	**10,548**
TOTAL IMPACTS		**21,988**	**68,937**	**11,724**	**13,122**	**21,589**	**10,548**

[a] See Appendix 12E for detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Affected roosting habitat acreages include valley/foothill riparian habitat, developed lands, and orchards. An unknown number of buildings, bridges, tunnels, and individual trees could also be affected but were not included in this analysis. Foraging habitat includes all natural communities, cultivated lands, and developed lands in the study area. Foraging habitat effects for CM2-CM18 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands).

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as the maximum possible based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 1C conservation measure CM1 would result in the permanent and temporary loss combined of up to 468 acres of roosting habitat and 16,833 acres of foraging habitat for special-status bats in the study area. DWR identified two bridges, one with positive bat sign that provided both day and night roosting habitat and the other a potential night roost, that could be affected by construction in CM1. Conservation measures Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5) and would result in the permanent and temporary loss of 1,782 acres of roosting habitat and the conversion of approximately 65,525 acres of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Habitat enhancement and management activities (CM11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect special-status bat habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 1C conveyance facilities would result in the permanent loss of approximately 135 acres of roosting habitat and 6,832 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 333 acres of roosting habitat and up to 10,451 acres of foraging habitat for special-status bats in the study area (Table 12-1C-61). DWR identified two bridges within the CM1 footprint. One bridge had positive bat sign and provided both day and night roosting habitat and was located in a new bridge construction area. The second bridge provided potential night roosting habitat and is located in a borrow area.
- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the conversion of approximately 2,025 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM2 would also result in the permanent removal of 89 acres and temporary removal of 167 acres of roosting habitat for special-status bats. The maternity colony of Mexican free-tailed bats located at both ends of the Yolo Causeway bridge could also be affected during construction for CM2. Implementation of Mitigation Measure BIO-166 *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would ensure that improvements in the Yolo Bypass avoid effects on roosting special-status bats.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of approximately 56,810 acres of foraging habitat into wetlands that could still be used by bats for foraging. Approximately 1,425 acres of roosting habitat for special-status bats would permanently affected. This habitat is of low value, consisting of a small, isolated patch surrounded by cultivated lands, and the species have a relatively low likelihood of being present in these areas. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, requires that tidal natural communities restoration avoid effects on roosting special-status bats.
- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the conversion of an estimated 3,690 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM5 would also result in the permanent removal of 57 acres and temporary removal of 45 acres of roosting habitat for special-status bats in the study area.
- *CM11 Natural Communities Enhancement and Management*: Implementation of Alternative 1C would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.

- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to conservation components could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 1C would permanently or temporarily affect 1,159 acres of roosting for special-status bats in the near-term as a result of implementing (468 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 601 acres of the 1,159 acres of roosting habitat losses would be in valley/foothill riparian habitat. Typical NEPA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 601 acres of riparian habitat should be restored and 601 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1C.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these effects.

The BDCP also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 1C as a whole would affect 2,250 acres of roosting habitat (Table 12-1C-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

NEPA Effects: In the near-term, the losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 1C are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of foraging and roosting habitat for special-status bats associated with Alternative 1C, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6 and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 1C as a whole on special-status bats would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 1C would permanently or temporarily affect 1,159 acres of roosting for special-status bats in the near-term as a result of implementing (468 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 601 acres of the 1,159 acres of roosting habitat losses would be in valley/foothill riparian habitat. Typical CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 601 acres of riparian habitat should be restored and 601 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and

Objective GNC1.1). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 1C.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these impacts to a less-than-significant level.

The permanent loss of roosting habitat from Alternative 1C would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The BDCP also contains commitments to implement AMM1–AMM6 and AMM10. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

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Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species roost in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset late long-term effects resulting from CM1, CM2, CM4, and CM5.

The permanent loss of roosting habitat from Alternative 1C would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. Therefore, Alternative 1C would not result in a significant impact on special-status bats under CEQA.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists would have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists would avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists would conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys would consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors would be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys would be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists would analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists would conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists would examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) would be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists would conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector would be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures would be determined by DWR in consultation with CDFW and shall include, as applicable, the measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.
- Disturbance of the bridge would be avoided between March 1 and October 31(the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices would only be installed by or under the supervision of an experienced bat biologist.
- Tree removal would be avoided between April 15 and September 15 (the maternity period for bats that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal would be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 3[1], later tree removal may be considered in consultation with CDFW.
- Trees would be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost would remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost would be avoided to the maximum extent feasible and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction would be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:
  - Eviction would not occur before September 15th and would match the timeframe for tree removal approved by CDFW.
  - Qualified biologists would carry out or oversee the eviction tasks and would monitor the tree trimming/removal.
  - Eviction would take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
  - Eviction would take place during weather and temperature conditions conducive to bat activity.

- Special-status bat roosts would not be disturbed.

Eviction procedures shall include but are not limited to:

- Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.
- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Noninjurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat would also be determined through consultation with CDFW and may include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, "bat bark," planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. "Bat bark" has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Plan Implementation on Special-Status Bats

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat over the term of the BDCP.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural communities restoration would potentially indirectly affect special-status bat species. *CM12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *CM12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from BDCP tidal natural communities restoration.

NEPA Effects: Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 1C would not have an adverse effect on special-status bats.

CEQA Conclusion: Indirect effects from conservation components operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would reduce these potential impacts to a less-than-significant level and ensure that Alternative 1C would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 324 acres of roosting habitat and 21,265 acres of foraging habitat for special-status bats in the study area (Table 12-1C-61).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate up to 411 acres of roosting habitat and 10,137 acres of foraging habitat for special-status bats (Table 12-1C-61). Potential roosting trees are likely to be retained within seasonally flooded areas, although high velocity flooding could uproot some trees. Seasonal flooding would not adversely affect foraging habitat for the species. The overall effect of seasonal inundation in existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for special-status bats that use riparian habitats.

***NEPA Effects*:** Periodic effects on roosting and foraging habitat for special-status bats associated with implementing Alternative 1C are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address any effects of periodic inundation on special-status bats and roosting habitat. Therefore, Alternative 1C would not adversely affect the species.

***CEQA Conclusion*:** Periodic inundation under CM2 and floodplain restoration under CM5 would periodically affect foraging and roosting habitat for special-status bats in the study area. Any impact of periodic inundation on special-status bats would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See discussion of Mitigation Measure BIO-166 under Impact BIO-166.

Plant Species

Vernal Pool Plants

Five covered plant species and 12 noncovered special-status plant species occur in vernal pools in the study area (Tables 12-2, 12-3, summarized in Table 12-1C-62). The vernal pool habitat model used for the impact analysis was based on vegetation types and associations from various data sets which were used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which the species are known to occur, including vernal pool complex and degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 1C.

Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit covered vernal pool plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Objective VPP1.1, associated with CM3).
- Maintain no net loss of Heckard's peppergrass in Conservation Zones 1, 8, or 11 within restoration sites or within the area of affected tidal range of restoration projects (Objective VPP1.2, associated with CM3 and CM9).

The construction and restoration activities covered under Alternative 1C could have impacts on special-status vernal pool plants. Modeled habitat is within the proposed footprint for the Alternative 1C water conveyance facilities and within the hypothetical footprints for restoration activities. In addition, three known occurrence of a covered plant species and two known occurrences of a noncovered plant species are within the proposed footprint for the Alternative 1C water conveyance facilities. Table 12-1C-62 summarizes the acreage of modeled vernal pool habitat in the study area, the number of occurrences of each special-status vernal pool plant in the study area, and potential effects.

Table 12-1C-62. Summary of Impacts on Vernal Pool Plants under Alternative 1C

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Vernal pool complex	9,557	61	0	0	Habitat loss from construction of water conveyance facilities and tidal restoration
Degraded vernal pool complex	2,493	376	0	0	Habitat loss from construction of water conveyance facilities and tidal restoration
Alkali Seasonal Wetland	188	15	0	0	Habitat loss from construction of water conveyance facilities
Total	12,238	452	0	0	
Covered Species					
Alkali milk-vetch	0	0	16	1	Occurrences affected by construction of water conveyance facilities
Dwarf downingia	0	0	12	0	None
Boggs Lake hedge-hyssop	0	0	1	0	None
Legenere	0	0	8	0	None
Heckard's peppergrass	0	0	4[a]	0	None
Noncovered Species					
Ferris' milk-vetch	0	0	6	2	Occurrences affected by construction of water conveyance facilities
Vernal pool smallscale	0	0	2	0	None
Hogwallow starfish	0	0	0	0	None
Ferris' goldfields	0	0	4	2	Occurrences affected by construction of water conveyance facilities
Contra Costa goldfields	0	0	7	0	None
Cotula-leaf navarretia	0	0	5	0	None
Baker's navarretia	0	0	3	0	None
Colusa grass	0	0	1	0	None
Bearded popcorn-flower	0	0	4	0	None
Delta woolly marbles	0	0	3	0	None
Saline clover	0	0	9	0	None
Solano grass	0	0	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Alternative 1C could affect habitat for special-status vernal pool plants and occurrences of two vernal pool plant species. The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operations*: Eighty acres of modeled habitat in CZ 8 are within the proposed footprint for the Alternative 1C water conveyance facilities, including 5.5 acres of critical habitat for Contra Costa goldfields, one known occurrence of alkali milk-vetch, two known occurrences of Ferris' milk-vetch, and two known occurrences of Ferris' goldfields. Construction and operation of the water conveyance facilities would not affect known occurrences of the other four covered vernal pool plants or the other 11 noncovered special-status plants. Under Alternative 1C, construction and operation of the water conveyance facilities could affect undiscovered occurrences of the five covered vernal pool plants or the 12 noncovered special-status plants. In addition, construction of the west transmission line option could affect potential habitat and undocumented occurrences of special-status vernal pool plants, including Ferris' milkvetch, Baker's meadowfoam, bearded popcornflower, Delta woolly marbles, and saline clover.
- *CM2 Yolo Bypass Fisheries Enhancement*: No modeled vernal pool habitat and no known occurrences of special-status vernal pool plant species are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Construction and operation of the Yolo Bypass fisheries enhancements would not affect the 17 covered or noncovered vernal pool plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit covered vernal pool plants by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1). The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species. These benefits also would accrue to any noncovered vernal pool plants occurring in the protected vernal pool complex.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would result in the inundation of an estimated acres of vernal pool complex and would, therefore, potentially affect special-status vernal pool plants. However, most of this habitat (370 acres) consists of degraded vernal pool habitat that is unlikely to contain special-status plants. In addition, 257.8 acres of critical habitat for Contra Costa goldfields could be affected. No known occurrences of covered and noncovered vernal pool plants would be affected by tidal restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered vernal pool plants.
- *CM6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered vernal pool plants.

- *CM7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM8 Grassland Natural Community Restoration*: Although the vernal pool complex habitat includes grassland matrix within which the vernal pools occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within vernal pool complex habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered vernal pool plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, BDCP activities result in the net loss of vernal pool habitat, CM9 would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plants would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool plants or potentially affect vernal pool habitat adjacent to the restoration areas.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on covered and noncovered vernal pool plants.
- *CM22 Avoidance and Minimization Measures*: Effects on covered vernal pool plants potentially resulting from implementation of CM4 would be avoided or minimized though *AMM11 Covered Plant Species, AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation. AMM2 Construction Best Management Practices and Monitoring*. AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. *AMM12 Vernal Pool Crustaceans* also requires that that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 will not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. AMM30 specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible. Effects on alkali milk-vetch would be avoided or minimized though implementation of AMM11 and AMM30. AMM37 requires that new recreation trails avoid populations of covered vernal pool plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In addition, the BDCP includes species-specific goals to benefit covered vernal pool plants. This includes protecting two occurrences of alkali milkvetch (Objective VPP1.1) and requiring no net loss of Heckard's peppergrass (Objective VPP1.2).

In summary, adverse effects on covered vernal pool plants could occur from implementing Alternative 1C. One known occurrence of alkali milk-vetch that could be affected under the current project design would be surveyed to establish the occurrence limits and to redesign the project to avoid affecting the occurrences, but only to the extent feasible. Beneficial effects on special-status vernal pool plants could occur by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 and by protecting occurrences of alkali milk-vetch. However, conservation measures that benefit or protect covered species do not apply to noncovered species, and two occurrences of Ferris' milk-vetch and two occurrences of Ferris' goldfields at Byron Tract Forebay would be adversely affected.

The GIS analysis estimated that up to 437 acres of vernal pool complex could be adversely affected by covered activities under Alternative 1C. However, the actual effect on habitat for special-status vernal pool plants is expected to be much less than the estimated impact because the BDCP limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants (Objective VPNC1.2, associated with CM9). This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts. Because most of the vernal pool habitat restoration would be applied to compensating for impacts of CM1, the limitation on the loss of wetted vernal pool habitat would prevent implementation of tidal restoration projects that are adjacent to vernal pool complex, which could affect the feasibility of restoring 65,000 acres of tidal habitat (Objective TPANC1.1, associated with CM4).

NEPA Effects: The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through CM9. Impacts on one occurrence of a covered vernal pool plant, alkali milk-vetch, could be avoided by project design. The loss of two occurrences of Ferris' milk-vetch and two occurrences of Ferris' goldfields, both noncovered species, would result in a reduction in the range and numbers of this species and would be an adverse effect. Implementation of Mitigation Measure BIO-170 for Ferris' milk-vetch and Ferris' goldfields could offset or avoid this effect. With avoidance and minimization, Alternative 1C would not result in adverse effects on covered and noncovered vernal pool plant species. If the impacts could only be mitigated through project design, and project design changes are infeasible, then the effects would be adverse.

CEQA Conclusion: Because loss of modeled habitat for vernal pool plant species would be offset through restoration, and because impacts on occurrences of covered vernal pool plants would be avoided, the impacts of Alternative 1C on 15 covered and noncovered special-status vernal pool plants in the study area would be less than significant. However, construction of the water conveyance facilities could result in the reduction in numbers and range of Ferris' milk-vetch and Ferris' goldfields, which would be significant impacts. Mitigation Measure BIO-32, *Restore and Protect Vernal Pool Crustacean Habitat*, and Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*, would reduce these impacts to a less-than-significant level. If the impacts could only be mitigated through project design, and project design changes are infeasible, then the impacts would be significant.

Mitigation Measure BIO-32: Restore and Protect Vernal Pool Crustacean Habitat

See discussion of Mitigation Measure BIO-32 under Impact BIO-32.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plants, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppy and caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for the special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered plants if feasible. The purpose of these surveys will be to verify that the locations of special-status plants identified in previous record searches or surveys are extant, identify any new special-status plant occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plants will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of covered fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having noncovered special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasible through the establishment of 250-foot activity exclusion zones surrounding the periphery of occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be established according to a 250-foot buffer surrounding the periphery of each plant species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.

- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Alkali Seasonal Wetland Plants

Five covered species and three noncovered plants occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1C-63). Alkali seasonal wetland habitat was modeled separately for four covered plant species occurring in seasonal alkali wetlands.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit covered alkali seasonal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Of the 150 acres of alkali seasonal wetland complex protected under Objective ASWNC1.1, 600 acres of vernal pool complex protected under Objective VPNC1.1, and 8,000 acres of grassland natural community protected under Objective GNC1.1, protect 75 acres of suitable brittlescale habitat and 75 acres of suitable heartscale habitat in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.1, associated with CM3).
- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.2, associated with CM3).

Alternative 1C would have adverse effects on modeled habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. It would also have adverse effects on occurrences of heartscale, Heckard's peppergrass, crownscale and recurved larkspur. Table 12-1C-63 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area, the number of occurrences of each special-status alkali seasonal wetland plant in the study area, and potential impacts.

1 **Table 12-1C-63. Summary of Impacts on Seasonal Alkali Wetland Plants under Alternative 1C**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale	14,933	823	0	0	Habitat loss from construction of water conveyance facilities, construction of Yolo Bypass fisheries enhancements, tidal habitat restoration, and floodplain restoration levee construction
Brittlescale modeled habitat	451	5	0	0	Habitat loss from construction of water conveyance facilities and tidal habitat restoration
Heartscale modeled habitat	6,528	307	0	0	Habitat loss from tidal habitat restoration
Delta button celery modeled habitat	3,361[a]	130	0	0	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	94	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration and Yolo Bypass fisheries enhancements
Covered Species					
San Joaquin spearscale	0	0	19	3	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Brittlescale	0	0	8	0	None
Heartscale	0	0	3	1	Population loss from transmission line construction
Delta button celery	0	0	1[b]	0	None
Heckard's peppergrass	0	0	1[c]	1	Occurrence affected by tidal habitat restoration
Noncovered Species					
Crownscale	0	0	17	2	Occurrences affected by construction of water conveyance facilities
Palmate-bracted bird's-beak	0	0	1	0	None
Recurved larkspur	0	0	4	1	Occurrence affected by construction of water conveyance facilities

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

2

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Modeled habitat for San Joaquin spearscale, Delta button-celery and brittlescale would be adversely affected by construction of the Alternative 1C water conveyance facilities. Two populations of San Joaquin spearscale, one population of crownscale, and one population of recurved larkspur also would be adversely affected by construction of the water conveyance facilities. Modeled habitat for brittlescale and heartscale could be adversely affected by tidal habitat restoration. One occurrence each of heartscale and Heckard's peppergrass could be affected by tidal habitat restoration. No adverse effects on palmate-bracted bird's-beak would be expected.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Under Alternative 1C, construction of the canal and associated facilities would permanently remove 144 acres of modeled habitat for San Joaquin spearscale, 130 acres of modeled habitat for Delta button-celery, and 1 acre of modeled habitat for brittlescale. This could be an adverse effect, depending on whether the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Two occurrences of San Joaquin spearscale, two occurrences of crownscale, and one occurrence of recurved larkspur would be affected near the Clifton Court Forebay by construction of the canal. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected.

  Construction of the water conveyance facilities would permanently remove 0.2 acre of habitat occupied by crownscale at the Byron Tract Forebay. Part of the occurrence would be removed, but most of the occurrence would not be directly affected. However, a reduction of the population size, both in area and number of individuals present, would be an adverse impact.

  Construction of the west transmission line option could affect one occurrence of heartscale along Goose Haven Road.

  Construction of the water conveyance facilities would not affect Heckard's peppergrass, or palmate-bracted bird's-beak.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass improvements would permanently remove 56 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No modeled habitat and no known occurrences of the seven other alkali seasonal wetland plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.

- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, and/or 11. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration is expected to convert alkali seasonal wetlands on the margins of tidal wetlands to freshwater or brackish tidal marsh. Tidal habitat restoration would convert 622 acres of modeled habitat for San Joaquin spearscale to tidal marsh. Tidal habitat restoration would permanently remove 4 acres of modeled habitat for brittlescale in CZ 1 near Lindsey Slough and in CZ 11 near Nurse Slough; however, the BDCP would allow up to 50 acres of modeled habitat to be converted to tidal wetlands. Tidal habitat restoration would remove 306 acres of modeled habitat for heartscale in CZ 1 in the vicinity of Jepson Prairie and in CZ 11 adjacent to Suisun Marsh. The extent to which the modeled habitat is actually occupied by these species is not known; modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Tidal habitat restoration could adversely affect one occurrence of Heckard's peppergrass at Hass Slough and one occurrence of San Joaquin spearscale at Main Prairie, both in CZ 1. These occurrences are based on historic records, and the whether the populations still exist is not known. In each case, the loss of modeled habitat and occurrences for covered species would be adverse effects. Delta button celery, crownscale, palmate-bracted bird's-beak, and recurved larkspur would not be affected by tidal habitat restoration.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the removal of 2 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No other alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM8 Grassland Natural Community Restoration*: Although the alkali seasonal wetland habitat includes the grassland matrix within which the wetlands occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within alkali seasonal wetland habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants. In addition, the BDCP would compensate for the loss of alkali seasonal wetlands from other conservation measures by restoring or creating 72 acres of alkali seasonal wetlands in Conservation Zones 1, 8, or 11 to achieve no net loss of this habitat.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *Avoidance and Minimization Measures*: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of CM1 and CM4 would be avoided or minimized

though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of covered species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on San Joaquin spearscale. AMM37 requires that new recreation trails avoid populations of covered alkali seasonal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, two known occurrences of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 1C, although one historic occurrence of Heckard's peppergrass and one historic occurrence of San Joaquin spearscale could be affected by tidal restoration activities, if those occurrences still exist. AMM11 would be implemented to avoid an adverse effect on the Heckard's peppergrass and San Joaquin spearscale occurrences.

The primary effect of Alternative 1C on special-status alkali seasonal wetland plants would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. Approximately 72 acres of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland plants is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the BDCP limits the total loss of wetted vernal pool habitat to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex (Objective VPNC1.2, associated with CM9). Approximately 72 acres of alkali seasonal wetlands would be restored (Objective ASWC1.2, associated with CM9). Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis (Objective GNC1.1, associated with CM8). These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

The BDCP would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland habitat. The BDCP also includes the species-specific goal that 75 acres would be modeled habitat for brittlescale and heartscale (Objective BRIT/HART/SJSC1.1) and another goal that would protect 2 occurrences of San Joaquin spearscale (Objective BRIT/HART/SJSC1.2). The benefits of habitat protection and management also would accrue to any noncovered alkali seasonal wetland plants occurring in the protected habitat. Because conservation measures that protect covered species do not apply to noncovered species, the loss of portions of the crownscale and recurved larkspur populations at Byron Tract Forebay would be an adverse effect.

NEPA Effects: Under Alternative 1C, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (CM8, CM9). Impacts on one occurrence of San Joaquin spearscale and one occurrence of Heckard's peppergrass would be avoided through AMM11, and one occurrence of heartscale would be avoided through AMM30. Impacts on two occurrences of San Joaquin spearscale could be avoided by project design. With avoidance and habitat restoration, these effects would not be adverse. The loss of two occurrences of crownscale and one occurrence of recurved larkspur, both noncovered species, would result in a reduction in the range and numbers of these species and would be an adverse effect. Adverse effects on crownscale and recurved larkspur could be avoided or offset through implementation of Mitigation Measure BIO-170. Because avoidance of these occurrences would require redesign of the main conveyance canal, project design changes to avoid this impact may be infeasible. Under those circumstances, the impacts would adverse.

CEQA Conclusion: Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of covered alkali seasonal wetland plants would be avoided, impacts on covered and one noncovered alkali seasonal wetland plants as a result of implementing Alternative 1C would be less than significant. However, the loss of all or portions of two crownscale populations and a recurved larkspur population at Byron Tract Forebay would be a significant impact. Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level. Because avoidance of these occurrences would require redesign of the main conveyance canal, project design changes to avoid this impact may be infeasible. Under those circumstances, the impacts would be significant and unavoidable.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species.

See discussion of Mitigation Measure BIO-170 under Impact BIO-169.

Grassland Plants

One covered plant and 11 noncovered special-status plants occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-1C-64). The only covered plant species occurring in grassland is Carquinez goldenbush. Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extend of alluvium deposits in close proximity to the actual rivers/streams.

Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit covered grassland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect three unprotected occurrences of the Carquinez goldenbush in Conservation Zones 1 and/or 11 (Objective CGB1.1, associated with CM3).
- Maintain and enhance occupied Carquinez goldenbush habitat to slow erosion and reverse degradation from livestock grazing (Objective CGB1.2, associated with CM11).

Of 78,047 acres of grasslands in the study area, Alternative 1C would adversely affect 2,957 acres under Alternative 1C, including 4 acres that are modeled habitat for Carquinez goldenbush. For 10 of the plants, no known occurrences would be affected. One of eight Carquinez goldenbush occurrences and one of five Parry's rough tarplant occurrences in the study area could be adversely affected by Alternative 1C. Table 12-1C-64 summarizes the acreage of grassland habitat in the study area, the number of occurrences of each special-status grassland plant in the study area, and potential effects.

Table 12-1C-64. Summary of Impacts on Grassland Plants under Alternative 1C

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	4	0	0	Habitat loss from tidal habitat restoration
Grassland	78,047	2,957	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, floodplain restoration, and construction of conservation hatcheries
Covered Species					
Carquinez goldenbush	0	0	10	1	Occurrence affected by tidal restoration
Noncovered Species					
Big tarplant	0	0	5	0	None
Round-leaved filaree	0	0	2	0	None
Pappose tarplant	0	0	7	0	None
Parry's rough tarplant	0	0	5	1	Periodic inundation of one occurrence as a result of Yolo Bypass operations
Small-flowered morning-glory	0	0	0	0	None
Diamond-petaled poppy	0	0	1	0	None
Stinkbells	0	0	1	0	None
Fragrant fritillary	0	0	4	0	None
Keck's checkerbloom	0	0	2	1	Population loss from transmission line construction
Gairdner's yampah	0	0	0	0	None
Streamside daisy[a]	0	0	1	0	None
Caper-fruited tropidocarpum	0	0	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified in the BDCP.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plant Species

Alternative 1C could have adverse effects on modeled habitat for Carquinez goldenbush. It could also affect one occurrence of Carquinez goldenbush, one occurrence of Parry's rough tarplant, and one occurrence of Keck's checkerbloom. Although Alternative 1C would have no expected effects on known occurrences of the other special-status plant species that occur in grasslands, the loss of 2,957 acres of grassland would have the potential to adversely affected undocumented populations of special-status grassland species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No modeled habitat for Carquinez goldenbush and no known occurrences of 12 of the 13 special-status grassland plants are within the proposed footprint for the Alternative 1C water conveyance facilities. The west transmission line alternative would cross one historic occurrence of Keck's checkerbloom, which could have an adverse effect on the population, if it is still present. About 664 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat primarily consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 627 acres of grassland habitat. Yolo Bypass operations would result in more frequent and longer inundation of 1,597 acres of grasslands in the Yolo Causeway (CZ 2) that include habitat for one occurrence of Parry's rough tarplant. Parry's rough tarplant is a summer-blooming plant that occurs in areas subject to occasional inundation during the wet season, such as swales and seasonal wetlands. Increasing the frequency or duration of inundation may decrease the distribution in some areas by making some conditions too wet but would also expand the distribution into areas that may currently be too dry. Overall, changing the frequency and duration of inundation in the area of this occurrence should not result in a substantial change in the range of numbers of Parry's rough tarplant. Construction and operation of the Yolo Bypass fisheries enhancements would not affect modeled habitat for Carquinez goldenbush or known occurrences of other special-status grassland plants.
- *CM3 Natural Communities Protection and Restoration*: Alternative 1C would preserve 8,000 acres of grassland habitat, some of which may contain modeled habitat for Carquinez goldenbush. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 1,122 acres of grassland habitat, including 4 acres of modeled habitat for Carquinez goldenbush along the eastern side of Suisun Marsh. Part of one Carquinez goldenbush occurrence within the hypothetical footprint of tidal restoration could be affected. Tidal restoration would have no impacts on other known occurrences of special-status grassland plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of new floodplain levees would result in the loss of 85 acres of grassland habitat, periodic inundation of the floodplain would affect 513 acres of grassland habitat, and another 399 acres of grassland habitat would be converted to riparian habitat. However, no modeled habitat for Carquinez goldenbush or known

occurrences of special-status grassland plants are present within areas proposed for floodplain restoration, and the affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered grassland plants.

- *CM6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered grassland plants.
- *CM7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered grassland plants.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would restore 2,000 acres of grassland habitat. Restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands. These areas do not currently provide habitat for special-status grassland plants. Therefore, grassland communities restoration would have no impacts on covered and noncovered grassland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plants would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on covered and noncovered grassland plants.
- *CM18 Conservation Hatcheries*: Construction of the conservation hatcheries would remove 35 acres of grassland habitat. The removed habitat would consist of ruderal herbaceous vegetation that would not be likely to provide habitat for special-status grassland plants. Therefore, construction of the conservation hatcheries would not be expected to affect special-status grassland plants.
- *Avoidance and Minimization Measures*: Effects on Carquinez goldenbush potentially resulting from implementation of CM4 and potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. AMM37 requires that new recreation trails would avoid populations of Carquinez goldenbush. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The primary effect of Alternative 1C on special-status grassland plants is the loss of potential (i.e., modeled) habitat for Carquinez goldenbush, including part of one known occurrence. Adverse effects on Carquinez goldenbush would be avoided through implementation of AMMs, which include surveys to establish the population limits and redesigning the project to avoid affecting the population, to the extent feasible. Protecting three unprotected occurrences of Carquinez goldenbush (Objective CGB1.1, associated with CM3) and maintaining and enhancing occupied Carquinez goldenbush (Objective CGB1.2, associated with CM11) would compensate for any residual effects. One occurrence of Parry's rough tarplant would be affected by CM2, but the effect is not expected to be adverse. One occurrence of Keck's checkerbloom could be adversely affected, but no other special-status grassland plants would be affected.

The BDCP would have a potential beneficial effect on special-status grassland plants by protecting 8,000 acres of grassland habitat. To ensure that this habitat preservation would specifically benefit Carquinez goldenbush, the plan proposes to protect at least three Carquinez goldenbush occurrences in CZs 1 and 11 that are currently not protected and to maintain and enhance occupied Carquinez goldenbush habitat. The preservation of modeled or potential habitat, together with avoidance and minimization of impacts on species occurrences, would reduce any effects of Alternative 1C implementation on covered grassland plants to a level that is no longer adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for Carquinez goldenbush would be offset through CM3, CM8, and CM11. Adverse effects on Keck's checkerbloom could be avoided or offset through implementation of Mitigation Measure BIO-170. With avoidance and habitat enhancement, these effects would not be adverse.

***CEQA Conclusion*:** Because adverse effects on special-status grassland plant species would be avoided or compensated for, Alternative 1Cwould not result in substantially reducing the numbers or restricting the range of one covered or 11 noncovered special-status grassland plants. However, conservation measures that benefit or protect covered species do not apply to noncovered species, and portions of one Keck's checkerbloom population could be adversely affected, which would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

See discussion of Mitigation Measure BIO-170 under Impact BIO-169.

Valley/Foothill Riparian Plants

Two covered plants and two noncovered special-status plants occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-1C-65). The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit covered valley/foothill riparian plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and enhance two occurrences of delta button celery. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of delta button celery for a total of two occurrences within the restored floodplain habitat on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. (Objective DBC1.1, associated with CM3 and CM11).
- Protect and enhance two occurrences of slough thistle. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of slough thistle for a total of two occurrences within the 10,000 acres of restored floodplain on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis (Objective ST1.1: associated with CM3 and CM11).

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 1C would adversely affect 932 acres, including 15 acres that are modeled habitat for Delta button-celery and 11 acres that are modeled habitat for slough thistle. Table 12-1C-65 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status grassland plant in the study area.

Table 12-1C-65. Summary of Impacts on Valley/Foothill Riparian Plants under Alternative 1C

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button celery modeled habitat	3,361[a]	15	0	0	Habitat loss from floodplain restoration
Slough thistle modeled habitat	1,834	11	0	0	Habitat loss from floodplain restoration
Valley/foothill riparian habitat	17,966	932	0	0	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta button celery	0	0	1[b]	1	Occurrence potentially affected by floodplain restoration
Slough thistle	0	0	2	2	Occurrences potentially affected by floodplain restoration
Noncovered Species					
Northern California black walnut	0	0	1	0	None
Wright's trichocoronis	0	0	1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland

[b] A second occurrence is in alkali seasonal wetland

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plants are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would be affected by restoration of seasonally inundated floodplain.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the water conveyance facilities would remove 126 acres of valley-foothill riparian habitat under Alternative 1C. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the proposed footprint for the Alternative 1C water conveyance facilities. Therefore, under Alternative 1C, construction and operation of the water conveyance facilities would not affect covered or noncovered special-status valley/foothill riparian plants.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction and operation of the Yolo Bypass fisheries enhancements would adversely affect 378 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect the covered or noncovered valley/foothill riparian plants.
- *CM3 Natural Communities Protection*: Alternative 1C would protect 552 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 552 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for tidal restoration. Therefore, tidal restoration would not affect the covered or noncovered valley/foothill riparian plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 15 acres of modeled habitat for Delta button-celery along the San Joaquin River in CZ 7. In addition, floodplain restoration would result in more frequent and longer inundation of 18 acres of modeled habitat for Delta button-celery in this area. The area affected contains one historic occurrence of Delta button celery. This occurrence is considered to be extirpated, because all habitat for Delta button-celery at his location has been converted to agriculture (California Department of Fish and Wildlife 2013). Therefore, Alternative 1C would not have an adverse effect on Delta button celery in CZ 7.

  The BDCP proposes to benefit Delta button-celery at this location by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of Delta button-celery. Although Delta button celery occurs in riparian habitat, it is not associated with woodland or scrub habitats; rather, it occurs in alkali seasonal wetlands in floodplains, which may or may not also contain adjacent woody riparian habitat. Restoring habitat for Delta button-celery may not be compatible with restoring woody riparian habitat. In addition, establishing new populations of Delta button-celery is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on Delta button-celery would be speculative.

Floodplain restoration levee construction would remove 11 acres of modeled habitat for slough thistle and would result in more frequent and longer inundation of 6 acres of modeled habitat for slough thistle along the San Joaquin River in CZ 7. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to riparian habitat. Whether the affected modeled habitat is actually occupied by slough thistle is not known; however, of two historic occurrences of slough thistle present in the study area, only one is considered to be extirpated (California Department of Fish and Wildlife 2013). The BDCP would protect and enhance two occurrences of slough thistle. If occurrences are not found in the study area, then two self-sustaining occurrences of slough thistle would be established using locally-sourced genetic material for a total of two occurrences within the restored floodplain habitat on the main stem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. Establishing new populations of slough thistle is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on slough thistle would be speculative.

One historic occurrence of Wright's trichocoronis in the study area near Lathrop (CZ 7) could also be affected by floodplain restoration. The occurrence is presumed to be extant because the presence or absence of suitable habitat has not been verified by field surveys (California Department of Fish and Wildlife 2013). However, the species has not been observed at this location for nearly a century, and habitat for Wright's trichocoronis, which would have been similar to that for Delta button celery and slough thistle, no longer appears to be present in aerial photographs of the area. Therefore, Alternative 1C would not be expected to have an adverse effect on Wright's trichocoronis.

- *CM6 Channel Margin Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM8 Grassland Natural Community Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool and alkali seasonal wetland complex restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on covered and noncovered valley/foothill riparian plants.

- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of CM5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 1C is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for covered plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 1C would not have an adverse effect on these species.

The BDCP proposes to benefit Delta button-celery and slough thistle by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of both species. Establishing new populations of Delta-button-celery or slough thistle would be a beneficial effect. However, establishing new populations is an untried, unproven procedure and may not be feasible.

NEPA Effects: Implementing the BDCP under Alternative 1C would not have an adverse effect on special-status valley/foothill riparian plant species.

CEQA Conclusion: Because Alternative 1C would not result in a reduction in the range and numbers of covered and noncovered valley/foothill riparian plants, this impact would be less than significant. No mitigation is required.

Tidal Wetland Plants

Seven covered plants and one noncovered special-status plant occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-1C-66). Five tidal wetland habitat models were developed for the seven covered plant species occurring in tidal wetland habitat.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitat cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 1C would include the following conservation actions over the term of the BDCP to benefit covered tidal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites, or within the area of affected tidal range of restoration projects (Objective DMW/ML1.1, associated with CM4 and CM11).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Objective DTP/SMA1.1, associated with CM4 and CM11).
- Restore tidal inundation to wetlands in the Hill Slough Ecological Reserve and to the ponded area at Rush Ranch (Objective SBB/SuT1.1, associated with CM4).
- Complete seed banking of all existing Suisun Marsh populations and the representative genetic diversity using accepted seed banking protocols (Objective SBB/SuT1.2, associated with CM11).
- Establish a cultivated population of Suisun thistle from wild seed using accepted seed collection protocols (Objective SBB/SuT1.3, associated with CM11).
- Establish two occurrences of Suisun thistle in Conservation Zone 11 (Objective SBB/SuT1.4, associated with CM11).

Of 17,357 acres of tidal wetlands in the study area, Alternative 1C would affect 10 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, Suisun Marsh aster, soft bird's-beak, and Suisun thistle. Known occurrences of these species would be affected. In addition, three occurrences of Bolander's water-hemlock, a noncovered special-status plant, could be affected by tidal habitat restoration. Table 12-1C-66 summarizes the acreage of modeled habitat for covered tidal wetland species and the number of occurrences of each special-status tidal wetland plants in the study area.

1 **Table 12-1C-66. Summary of Impacts on Tidal Wetland Plants under Alternative 1C**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/Mason's lilaeopsis modeled habitat	6,081	41	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Side-flowering skullcap modeled habitat	2,497	22	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Soft bird's-beak modeled habitat	1,228	73	0	0	Habitat loss from tidal habitat restoration
Delta tule pea/Suisun Marsh aster modeled habitat	5,853	1	0	0	Habitat loss from tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Suisun thistle modeled habitat	1,281	73	0	0	Habitat loss from tidal habitat restoration
Tidal brackish emergent wetland	8,501	0	0	0	Habitat loss from tidal habitat restoration
Tidal freshwater emergent wetland	8,856	10	0	0	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta mudwort	0	0	58	3	Occurrences affected by tidal habitat restoration
Delta tule pea	0	0	106	26	Occurrences affected by tidal habitat restoration
Mason's lilaeopsis	0	0	181	17	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Side-flowering skullcap	0	0	12	0	None
Soft bird's-beak	0	0	13	7	Occurrences affected by tidal habitat restoration
Suisun Marsh aster	0	0	164	27	Occurrences affected by construction of water conveyance facilities, Yolo Bypass fisheries enhancements, and tidal habitat restoration
Suisun thistle	0	0	4	0	Occurrences affected by tidal habitat restoration
Noncovered Species					
Bolander's water hemlock	0	0	8	3	Occurrences affected by tidal habitat restoration

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 1C would have adverse effects on tidal marsh special-status plants through implementation of CM1, CM2, CM4, and CM5. No adverse effects are expected from implementation of CM3, CM6, CM7, CM8, and CM9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would remove 27 acres of modeled habitat for delta mudwort and Mason's lilaeopsis and 17 acres of modeled habitat for side-flowering skullcap. The extent to which modeled habitat is actually occupied by these species is not known; however, 2 occurrences of Mason's lilaeopsis and one occurrence of Suisun Marsh aster in the study area could be affected by construction impacts. No known occurrences of the other covered and noncovered tidal wetland species would be affected by construction of the water conveyance facilities.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 5 acres of modeled habitat for Mason's lilaeopsis and delta mudwort. The extent to which modeled habitat is actually occupied by these species is not known; however, no known occurrences in the study area would be affected. Yolo Bypass operations would result in more frequent and longer inundation of 8 acres of modeled habitat Delta tule peas and Suisun Marsh aster. Two occurrences of Suisun Marsh aster would be affected by Yolo Bypass operations. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes restoring or creating 20 linear miles of transitional tidal areas within other natural communities that would be created or restored, including 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland. In addition, the habitat and ecosystem functions of these areas would be maintained and enhanced. The BDCP does not specifically propose to protect any occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences. Instead, the BDCP assumes that the 20 linear miles of restored transitional tidal areas would be passively colonized by the covered tidal wetland plants.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 6 acres of modeled habitat for Mason's lilaeopsis and Delta mudwort. Habitat loss would occur through conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 14 of 181 known occurrences of Mason's lilaeopsis and 3 of 58 known occurrences of delta mudwort in the study area could be affected by tidal habitat restoration.

  Tidal habitat restoration would remove 4 acres of modeled habitat for side-flowering skullcap. Whether the affected modeled habitat is actually occupied by side-flowering skullcap is not known; however, none of the 12 known occurrences in the study area would be affected.

  Tidal habitat restoration would remove 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. However, the BDCP would allow up to 50 acres of modeled habitat to be removed. Habitat loss would result from conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 26 of 106 known occurrences of Delta tule pea and 24 of 164 occurrences of Suisun Marsh aster in the study area would be affected.

Tidal habitat restoration could affect 73 acres of modeled habitat for soft bird's-beak and Suisun thistle, including 1.3 acres of critical habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, seven of 13 known occurrences of soft bird's-beak in the study area could be affected. None of the four known occurrences of Suisun thistle in the study area would be affected.

Tidal habitat restoration could affect three of eight known occurrences of Bolander's water-hemlock, a noncovered special-status species in the study area. Because Bolander's water-hemlock occurs in tidal marsh, it may benefit from tidal marsh restoration. However, site preparation, earthwork, and other site activities could adversely affect Bolander's water-hemlock through direct habitat removal.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 3 acres of modeled habitat for Mason's lilaeopsis and delta mudwort and 2 acres of modeled habitat for side-flowering skullcap. No known occurrences of these species in the study area would be affected by floodplain restoration.

  Floodplain restoration would result in more frequent and longer inundation of 2 acres of modeled habitat for Mason's lilaeopsis and delta mudwort, 18 acres of modeled habitat for side-flowering skullcap, and 1 acre of modeled habitat for Delta tule peas and Suisun Marsh aster. No known occurrences of these species in the study area would be affected by periodic inundation of restored floodplain habitat. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed separately from the effects of tidal habitat restoration. Channel margin enhancement would have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would have beneficial effects on these species by improving the habitat functions for these species as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.

- *CM7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of CM4 and CM5. Riparian plantings carried out for CM7 would be placed in floodplain areas, not in tidal wetlands.

- *CM8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on covered and noncovered tidal wetland plants.
- *Avoidance and Minimization Measures*: Effects on covered tidal wetland plants potentially resulting from implementation of CM1, CM2, CM4, and CM5 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM30 Transmission line Design and Alignment Guidelines*, and *AMM37*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 contains specific guidance to avoid adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis and Suisun Marsh aster. AMM37 requires that new recreation trails avoid populations of covered tidal wetland plants. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, the GIS analysis indicates that Alternative 1C would result in the loss of modeled habitat for all of the covered species and result in adverse effects on known occurrences of most of the special-status plants occurring in tidal wetlands. However, the BDCP predicts that habitat restoration activities would greatly expand the amount of habitat available to each of these species, offsetting any potential loss of habitat or occurrences resulting from covered activities.

Delta mudwort could lose 41 acres of modeled habitat (0.7%), including all or part of three occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta mudwort, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Mason's lilaeopsis could lose 41 acres of modeled habitat (0.7%), including all or part of 17 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Mason's lilaeopsis; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Delta tule pea could lose 1 acre of modeled habitat (0.02%), including all or part of 26 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta tule pea, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta tule pea; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

Suisun Marsh aster could lose 1 acre of modeled habitat (0.02%), including all or part of 27 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun Marsh aster, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Suisun marsh aster; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would occur and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

All four of these species (Delta mudwort, Mason's lilaeopsis, Delta tule pea, and Suisun Marsh aster) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring large areas of habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected (less than 1% of the total), it is likely that the initial adverse effects of covered activities on these species would be offset and that the overall effect of Alternative 1C on these species would not be adverse.

Side-flowering skullcap could lose 22 acres of modeled habitat (0.9%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by side-flowering skullcap, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for side-flowering skullcap; creation of suitable habitat under these measures could also help offset this habitat loss. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, and because loss of modeled habitat for the species would be offset through restoration, the overall effect of Alternative 1C on this species would not be adverse.

Soft bird's-beak could lose 73 acres of modeled habitat (6%), including all or part of seven occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4

(Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by soft bird's-beak, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve would be done to increase potential habitat there for soft bird's-beak (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for soft bird's-beak. Although no active restoration of this species is proposed, post-implementation monitoring of soft bird's-beak occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Soft bird's-beak has a restricted distribution in the study area with highly localized occurrences, and habitat modification is the primary factor responsible for the species' decline and limiting the species' distribution and abundance. Improving habitat functions for this species would provide a reasonable expectation that the distribution and abundance of soft bird's-beak would also improve. Although a substantial amount of modeled habitat could be affected, the primary habitat for soft bird's-beak is high tidal brackish marsh, and the affected habitat is low tidal brackish marsh. Therefore, it is likely that the overall effect of Alternative 1C on this species would not be adverse.

Suisun thistle could lose 73 acres of modeled habitat (6%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun thistle, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve and at Rush Ranch would be done to increase potential habitat there for Suisun thistle (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for Suisun thistle. In addition, two new occurrences of Suisun thistle would be established in CZ 11 (Objective SBB/SuT1.4, associated with CM11). Post-implementation monitoring of Suisun thistle occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Habitat restoration, enhancement of habitat functions, and establishment of new occurrences would offset any potential loss of modeled habitat for Suisun Marsh thistle.

Three occurrences of Bolander's water-hemlock could be affected. Although the extent of potential habitat affected was not determined, it would be comparable to that for Delta tule pea and Suisun Marsh aster (5 acres). Tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) could increase the extent of habitat available for colonization by Bolander's water-hemlock, which could offset this habitat loss. Because only a few scattered occurrences of Bolander's water-hemlock are present in the study area, there is no reasonable expectation that habitat restoration without active species-specific restoration activities would result in the establishment of new occurrences to offset the losses. Also, because Bolander's water-hemlock is a noncovered species, the species protections and occurrence monitoring afforded to covered species under the BDCP would not apply to this species. Therefore, the effects of Alternative 1C on Bolander's water hemlock could be adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (CM4). Therefore, implementation of Alternative 1C would result in no adverse effects on seven of eight special-status grassland plants in the study area. Alternative 1C would result in a reduction in the range and numbers of Bolander's water-hemlock, which would be an adverse effect. Adverse effects on Bolander's water-hemlock could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of occurrences and modeled habitat for covered tidal habitat plant species would be offset through habitat restoration, impacts on covered tidal wetland plants resulting from implementation of Alternative 1C would be less than significant. However, the loss of Bolander's water-hemlock populations in CZ 11 would be a reduction in the species' numbers and range, which would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-169.

Inland Dune Plants

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 1C would have no adverse effects on inland dune plants (Table 12-1C-67). No construction activities or habitat restoration would take place where the species occur. No specific actions to benefit inland dune species are proposed.

Table 12-1C-67. Summary of Impacts on Inland Dune Plants under Alternative 1C

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Inland Dunes	19	0	0	0	None
Noncovered Species					
Hoover's cryptantha	0	0	1	0	None
Antioch Dunes buckwheat	0	0	1	0	None
Mt. Diablo buckwheat	0	0	1	0	None
Contra Costa wallflower	0	0	3	0	None
Antioch Dunes evening-primrose	0	0	9	0	None

NEPA Effects: Implementing the BDCP under Alternative 1C would not affect special-status inland dune plant species.

CEQA Conclusion: Alternative 1C would have no impacts on inland dune plant species. No mitigation is required.

Nontidal Wetland Plants

No covered plant species occur in nontidal wetlands in the study area; however, six noncovered special-status plant species occur in nontidal wetlands in the study area. Table 12-1C-68 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland plant in the study area.

Table 12-1C-68. Summary of Impacts on Nontidal Wetland Plants under Alternative 1C

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	311	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Nontidal freshwater perennial emergent wetland	1,509	131	0	0	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Noncovered Species					
Watershield	0	0	3	0	None
Bristly sedge	0	0	18	0	Loss of habitat from construction of water conveyance facilities
Woolly rose-mallow[a]	0	0	121	4	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Eel-grass pondweed	0	0	1	1	Loss of habitat from construction of water conveyance facilities
Sanford's arrowhead	0	0	23	1	Loss of habitat from tidal habitat restoration
Marsh skullcap[a]	0	0	3	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 1C, known occurrences of woolly rose-mallow, eel-grass pondweed, and Sanford's arrowhead are within the proposed footprint for the water conveyance facilities or within the hypothetical footprint for restoration activities and could be adversely affected. Alternative 1C would have no adverse effects on watershield, bristly sedge, or marsh skullcap.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 1C water conveyance facilities would adversely affect two noncovered special-status plants occurring in nontidal wetlands. One occurrence of woolly rose-mallow in CZ 3 and two occurrences in CZ 8 would be affected by construction activities. One occurrence of eel-grass pondweed could be affected by construction activities on the Webb Tract in CZ 6. Four other noncovered nontidal wetland plants would not be affected by construction of the water conveyance facilities.

- *CM2 Yolo Bypass Fisheries Enhancement*: No known occurrences of special-status nontidal wetland plants are present in the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect special-status nontidal marsh plants.
- *CM3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under the BDCP. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *CM4 Tidal Natural Communities Restoration*: One known occurrence of Sanford's arrowhead is present within areas proposed for tidal habitat restoration in CZ 2, and one occurrence of woolly rose-mallow is present in areas proposed for tidal habitat restoration in CZ 7. Therefore, tidal habitat restoration would have an adverse effect on these species. No other special-status tidal wetland plants would be affected.
- *CM5 Seasonally Inundated Floodplain Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on special-status nontidal wetland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status nontidal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status nontidal wetland plants.
- *CM8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool and alkali seasonal wetland complex restoration would have no impacts on special-status nontidal wetland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. The BDCP may benefit nontidal wetland species by creating 400 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for covered and other native species. However, no specific actions to benefit noncovered species are proposed.

Under Alternative 1C, 1,500 acres of nontidal marsh would be restored (Objective NFEW/NPANC1.1, addressed under CM10). However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to woolly rose-mallow, eel-grass pondweed, and Sanford's arrowhead, potential loss of habitat or occurrences resulting from covered activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under the BDCP, the species protections afforded to covered species under the AMMs do not apply to these species, and the effects of Alternative 1C on these species would be adverse.

***NEPA Effects*:** Implementation of the BDCP under Alternative 1C could result in a reduction in the range and numbers of woolly rose-mallow, eel-grass pondweed, and Sanford's arrowhead, three noncovered nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

***CEQA Conclusion*:** Under Alternative 1C, tidal habitat restoration could result in a reduction in the range and numbers of woolly rose-mallow and eel-grass pondweed. Tidal habitat restoration could result in a reduction in the range and numbers of Sanford's arrowhead and woolly rose-mallow. These impacts would be significant. Implementation of Mitigation Measure BIO-170 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-169.

General Terrestrial Biology

Wetlands and Other Waters of the United States

Alternative 1C actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The Section 404 regulations and relevant information on mitigating impacts on wetlands and waters of the United States are described in Section 12.2.1.1. The following two impacts address the project-level effects of CM1 on these potential wetlands and waters, and the programmatic-level effects of other relevant conservation actions (CM2–CM10). CM11–CM21 would not directly result in loss or conversion of wetlands or other waters of the United States. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. The waters of the United States data used for this analysis is based on a verified wetland delineation from the USACE that was completed in early 2015. These waters of the United States were mapped at finer scale than that which was done for the natural community mapping for the BDCP; therefore, the acreages of these two datasets differ. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States

Alternative 1C proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-1C-69. Based on the methodology used to conduct this analysis, these losses would occur at pipeline, canal and intake areas, RTM and borrow/spoil storage sites, transmission corridors, forebay site, and multiple temporary work areas associated with the construction activity. The permanent open water and wetland losses would occur at various locations along the water conveyance facility alignment, but the majority of the loss would occur due to construction of Alternative 1C's five intake structures along the western bank of the Sacramento River from just north of Clarksburg to Courtland in the north Delta (including associated spoil/borrow areas), along the entire canal route in the west and south Delta, and at the southern forebay site in the south Delta. The temporary open water and wetland effects would also occur mainly at the five intake construction sites along the western bank of the Sacramento River, at temporary siphon work areas where the canal crosses under north and west Delta sloughs and waterways, and at barge offloading sites in the west Delta.

Table 12-1C-69. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 1C (acres)

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact	Total Impact
Agricultural Ditch	242.4	57.1	0	299.5
Alkaline Wetland	55.6	9.4	0	65.0
Clifton Court Forebay	0	0	0	0
Conveyance Channel	15.2	14.3	0	29.5
Depression	3.7	1.3	0	5.0
Emergent Wetland	116.9	24.3	0	141.2
Forest	1.6	14.4	0	16.0
Lake	0.2	3.7	0	3.9
Natural Channel	0.1	0.1	0	0.2
Scrub-Shrub	3.0	4.5	0	7.5
Seasonal Wetland	67.0	20.8	0	87.7
Tidal Channel	27.1	116.5	0	143.6
Vernal Pool	0.1	0	0	0.1
Total	**533**	**266**	**0**	**799**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

The majority of the impacts on wetlands and waters of U.S. are on wetlands and waters found within cultivated lands (agricultural ditches and seasonal wetlands), emergent wetlands, and tidal channels. These impacts mostly result from reusable tunnel material storage area, the construction of the canal, siphon work areas, and intake work areas. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g. reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the Clean Water Act permitting process. The results of this assessment will be compared to the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands would be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Because many impacted wetlands are significantly less than high function, the compensatory mitigation would result in a net increase in wetland function.

Alternative 1C was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures would be implemented, as described in the AMMs set out in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the United States are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, would also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing CM4–CM10, some of which could serve the dual purpose of offsetting effects to species and mitigating impacts on waters of the United States, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 1C pursuant to USACE's and EPA's Mitigation Rule (see Section 12.2.1.1). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to address adverse impacts on waters of the United States.

***NEPA Effects*:** The permanent and temporary loss of these jurisdictional wetlands and waters as a result of constructing Alternative 1C water conveyance facilities would be a substantial effect if not compensated by wetland protection and/or restoration. This loss would represent a removal of federally protected wetlands as defined by Section 404 of the CWA. Impacts on wetlands from CM1 construction would occur in the first 10 years after BDCP approval. Approximately 19,550 acres of this wetland restoration would occur during this time period. Project proponents under Alternative 1C would implement AMM1AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. Specific mitigation would be required to ensure that Alternative 1C does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

***CEQA Conclusion*:** The permanent and temporary loss of jurisdictional wetlands and waters as a result of constructing Alternative 1C water conveyance facilities would be substantial effect if not compensated for by wetland protection and/or restoration. This loss would represent either temporary or permanent removal of federally protected wetlands or other waters of the United States as defined by Section 404 of the CWA. Specific mitigation would be required to ensure that

Alternative 1C does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level. Alternative1C does propose to restore up to 76,721 acres of wetland natural communities under the Plan, which would include 65,000 acres of tidal marsh restoration (CM4), 10,000 acres of seasonally inundated floodplain restoration (CM5), 21 acres of vernal pool/alkali seasonal wetlands (CM9; 67 acres of vernal pool complex and 72 acres of alkali seasonal wetland complex assuming a wetland density of 15%), and 1,700 acres of nontidal marsh restoration (CM10). In addition, Alternative 1C would restore 5,000 acres of riparian habitat (CM7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 20 miles of levees will have channel margin enhancement conducted on them (CM6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees.

The success in implementing these Conservation Measures would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP Chapter 3, *Conservation Strategy*, for tidal marsh restoration (BDCP Section 3.4.4), seasonal floodplain restoration (BDCP Section 3.4.5.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 1C would also result in the protection and management of the following natural communities that contain wetlands: 750 acres of valley/foothill riparian, 600 acres of vernal pool complex, 150 acres of alkali seasonal wetland complex, 8,100 acres of managed wetlands, and 50 acres of nontidal marsh. In addition, 8,000 acres of grasslands and 51,625 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Project proponents under Alternative 1C would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 1C does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site *Restoration*, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site *Restoration*, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 1C's other conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and other waters of the United States in the study area during the course of BDCP conservation action implementation. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures (CM2, CM4, and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in Chapter 5, *Effects Analysis*, of the BDCP.

Because the wetland delineation was only conducted within the Conveyance Planning Area and not the remainder of the Plan Area, the effects on potential wetlands and waters of the United States from CM2–CM10 were analyzed by looking at effects on wetland natural communities mapped within the theoretical footprints for CM2, CM4, and CM5 by assuming that 100% of the predominantly wetland natural communities listed in Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, and that 10% of all of the non-wetland natural communities listed in that table would qualify as wetlands or other waters of the United States under the CWA. Based on this approach approximately 19,850 acres of potentially jurisdictional wetlands and waters could be affected by CM2-CM10. The majority of these impacts are attributable to the conversion of 13,746 acres of managed wetland to tidal marsh under CM4, which would likely result in an improvement of wetland function in the Plan Area.

***NEPA Effects*:** The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1C would be approximately 19,850 acres,. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. Although the increase in wetland acreage and wetland functions from these restoration actions could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

***CEQA Conclusion*:** The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 1C would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. In total, up to 76,721 acres of wetland natural communities would be restored under Alternative 1C. Although the increase in wetland acreage and wetland functions from these restoration could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds. The primary effects of concern for shorebirds and waterfowl are related to the conversion of managed wetland and cultivated lands to tidal marsh associated with habitat restoration. Ducks Unlimited (2013) conducted an analysis to determine the effects of BDCP conservation measures on waterfowl, as well as to determine whether BDCP actions would impede attainment of the goals established by the Central Valley Joint Venture (CVJV) Implementation Plan for the Delta, Yolo, and Suisun Marsh drainage basins. The CVJV efforts are guided by its 2006 Implementation Plan, which is founded on the principles of strategic habitat conservation (Central Valley Joint Venture 2006). Those principles emphasize the establishment of population abundance objectives and the use of species-habitat models to link population objectives to habitat needs. The CVJV has used species-habitat models to translate bird abundance objectives into habitat objectives, while explicitly identifying the biological assumptions that underpin these models and the data used to populate them. As a result, the CVJV's biological planning provides a framework for evaluating the effects of the BDCP on waterfowl.

The Ducks Unlimited waterfowl analysis focused primarily on dabbling ducks. Less than 5% of all geese in the Central Valley occur in the Yolo, Delta, and Suisun Marsh drainage basins. Moreover, geese in the Central Valley rely mostly on agricultural habitats to meet their food energy needs. The BDCP's effect on agricultural habitats is limited to the Delta Basin where about 2500 acres of corn now available to geese would be converted to other habitats (Ducks Unlimited 2013: Table 5). Food supplies for geese would still be well in excess of demand even with the loss of these agricultural habitats (Central Valley Joint Venture 2006, Ducks Unlimited 2013). The duck population objectives used in the analysis were taken directly from the CVJV Plan. Dabbling duck species make up 92% of this objective, while diving duck species make up the remaining 8%. Thus, the results were mostly driven by dabbling duck needs and largely interpreted in the context of dabbling duck foraging ecology. The 55,000 acres of Tidal Natural Communities Restoration (CM4) would be expected to benefit diving ducks by providing deep water foraging habitat. Refer to the Ducks Unlimited Report (Ducks Unlimited 2013) for details of the analysis and methods with respect to the TRUMET model used to quantify effects on food biomass and food quality.

An analysis was conducted to determine the effects of the BDCP covered activities on wintering and breeding shorebird habitat (ICF International 2013). This analysis evaluated the relative increase and decrease in natural communities known to provide important foraging, roosting, and breeding habitat. Similar to the waterfowl analysis, the results were broken up into the three Central Valley Joint Venture Basins that overlap with the BDCP study area: Yolo, Delta, and Suisun. Natural community losses and gains were then translated into species-specific outcomes, comparing the relative habitat value of each BDCP natural community for each Central Valley shorebird species (Table 1, ICF International 2013). The shorebird species ranking system displayed in Table 1 (ICF International 2013) was modified from a table in Stralberg et. al (2010). The table was created using survey data and experts' species-specific habitat rankings. The survey data included fall, winter, and spring density data. This resulted in an overall, cross-season representation of habitat requirements.

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities (CM1) would result in the permanent removal of approximately 1 acre of managed wetland, 22 acres of nontidal wetlands, and 4,140 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 145 acres of managed wetland, 1 acre of tidal wetlands, 26 acres of nontidal wetlands, and 5,429 acres of cultivated lands would be temporarily impacted.

These losses of habitat would occur within the first 10 years of Alternative 1C implementation in the Delta Basin. The BDCP has committed to the near-term protection of 15,400 acres of non-rice cultivated lands, 200 acres of rice, and 700 acres of rice or “rice equivalent” natural communities including nontidal wetlands in the near-term. In addition, 4,100 acres of managed wetlands would be created, protected, and enhanced, 8,850 acres of freshwater tidal wetlands would be restored, and 2,000 acres of tidal brackish emergent wetland would be restored (Table 3-4, Chapter 3).

Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***NEPA Effects*:** Habitat loss from construction of the Alternative 1C water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse affect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***CEQA Conclusion*:** Habitat loss from construction of the Alternative 1C water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Conservation Components

Suisun Marsh: Managed seasonal wetlands in Suisun Marsh would be reduced by an estimated 8,818 acres as a result of Alternative 1C implementation. This would represent a 25% decrease in managed seasonal wetlands compared with long-term conditions without Alternative 1C (Ducks Unlimited 2013, Table 5). There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh’s managed wetlands, which makes it difficult to identify the amount of mitigation needed. To address this uncertainty, three levels of food biomass and three levels of nutritional quality were modeled for these existing habitats (Ducks Unlimited 2013, Table 7). Three mitigation scenarios based on these energetic assumptions of biomass and food quality were then run to determine a minimum acreage of managed seasonal wetlands to be protected and enhanced to compensate for the loss of productivity resulting from habitat conversion to tidal wetlands.

- Scenario 1) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 50% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 60% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 5,000 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 2) Assume that the managed seasonal wetlands lost provide medium food biomass and medium food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun Marsh could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 13,300 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 3) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Given the assumption that managed seasonal wetlands in Suisun Marsh could only be enhanced to provide medium food biomass and medium food quality (produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, with these seeds having 80% of the metabolizable energy of seeds produced outside of Suisun Marsh), 8,800 acres of managed wetlands protected and managed for medium biomass and medium food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

The BDCP has committed to protecting and enhancing a minimum of 5,000 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity from habitat conversion to tidal marsh. This minimum commitment of 5,000 acres would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this potential effect.

Yolo and Delta Basins: The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to have an adverse effect on food productivity, under the assumption that these wetlands would provide adequate food sources. However, a monitoring component and a food study in these tidal habitats would be necessary in order to demonstrate that there would be a less than significant loss of food value in these habitats for wintering waterfowl. If it is determined from monitoring that there in fact would be a significant loss in food productivity resulting from habitat conversion to tidal wetlands, the protection and enhancement of managed wetlands in these watersheds would require mitigation for the change in food biomass and quality. Mitigation

Measure *BIO-179b, Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty.

***NEPA Effects*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of effect that Alternative 1C habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1C to avoid an adverse effect on wintering waterfowl in the Suisun Marsh. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these new wetlands would provide adequate food sources is entirely dependent on assumptions about food production in palustrine tidal habitats. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty and avoid an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of impact that Alternative 1C habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food for wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 1C to avoid having a significant impact on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Implementation of Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would address this potential significant impact.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity. However, the conclusion that these tidal wetlands would provide adequate food sources for wintering waterfowl is entirely dependent on assumptions about food production in palustrine tidal habitats. Studies of food biomass and food quality in palustrine tidal habitats are needed to confirm that no mitigation for wintering waterfowl would be required in the Yolo and Delta Basins. Implementation of Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would address this uncertainty and would reduce this impact on wintering waterfowl to a less-than-significant level.

Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh

Poorly managed wetlands (considered low biomass and food quality) will be identified and managed by BDCP proponents to improve food quality and biomass. Studies will be required to quantify 1) food production of existing managed wetlands in Suisun Marsh and 2) energetic productivity of brackish and tidal marsh habitats. Protected wetlands will be monitored to measure changes in the energetic productivity of these sites. Based on the food studies and monitoring results, BDCP proponents will determine if the minimum commitment of 5,000 acres is sufficient to meet the goal of 1:1 compensation for loss of wintering waterfowl habitat with the protection and management of managed wetlands in perpetuity. If monitoring demonstrates that additional acreage is needed to meet this goal, additional acreage of protection or creation of managed wetlands and management will be required.

Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins

In order to address the uncertainty of the impact of loss of managed wetlands in the Yolo and Delta Basins on wintering waterfowl, BDCP proponents will conduct food studies and monitoring to demonstrate the food quality of palustrine tidal habitats in these basins. If studies show that the assumption of no effect was inaccurate, and the food quality goal of 1:1 compensation for wintering waterfowl food value is not met, additional acreage of protection or creation of managed wetland and management will be required.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Conservation Components

Implementation of Alternative 1C would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1C implementation would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. While a reduction in these semipermanent habitats would represent a habitat loss for breeding waterfowl, with the restoration of 24,000 acres of palustrine tidal wetlands (Table 3-4, Chapter 3) in the Yolo and Delta basins there would be a less than adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (i.e., March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1C.

Suisun Marsh: Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres from the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared to seasonally managed habitats (Central Valley Joint Venture 2006).

The BDCP includes a commitment to protect and enhance 1,600 acres of permanently flooded managed wetlands in Suisun Marsh to provide habitat for breeding waterfowl. In addition, 5,000 acres of semipermanent wetlands that would be protected and enhanced for wintering and migratory waterfowl (Objective MWNC1.1, BDCP Chapter 3, *Conservation Strategy*).

Food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. These studies would be needed in order to quantify impacts on breeding waterfowl in Suisun Marsh and to determine not only the number of acres that would compensate for loss of breeding habitat at a ratio of 1:1 for habitat value, but how those acres should be managed. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of this effect.

In addition to providing semipermanent wetlands to breeding waterfowl, the Suisun Marsh contains several key upland areas that have significant nesting value. The largest block of upland habitat in the region is the core area on the Grizzly Island Wildlife Area. This area does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this core area includes over 2,000 acres of upland grasslands that have some of the highest duck nesting densities in California (Central Valley Joint Venture 2006). A few small wetland areas are scattered within this core grassland mosaic that provide necessary freshwater brooding habitat. If restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding waterfowl would likely be greatly increased.

NEPA Effects: Alternative 1C would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1C would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1C would not have an adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1C implementation. Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but such management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss of breeding waterfowl habitat resulting from implementation of Alternative 1C could have an adverse effect. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of model assumptions and the potential adverse effect of habitat conversion on breeding waterfowl in Suisun Marsh.

CEQA Conclusion: Alternative 1C would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 1C would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203, acres respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 1C would have a less-than-significant impact on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 1C.

Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss or conversion of habitat from implementation of Alternative 1C could have a significant impact on breeding waterfowl in Suisun Marsh. Implementation of Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would address the uncertainty of model assumptions and reduce the impact to a less-than-significant level.

Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

To address the uncertainty of the impact of loss of managed wetlands in Suisun Marsh on breeding waterfowl, BDCP proponents will conduct food studies and monitoring to determine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the marsh.

The required studies will examine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the Marsh. Reproductive studies will address but will not be limited to the following questions:

- How does the distribution of breeding waterfowl in Suisun Marsh differ in tidal versus managed habitats and across salinity gradients?
- How does waterfowl nest success and nest density vary with respect to tidal versus managed habitats and across salinity gradients?
- What are the patterns of habitat selection and movements by waterfowl broods in relation to tidal vs. managed habitats, and are there impacts on duckling survival?

- What is the current relationship between waterfowl reproductive success and interactions with alternate prey and predators, and how is tidal restoration likely to alter these relationships?

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

Yolo Basin: Primarily as a result of *CM4 Tidal Natural Communities Restoration* within the Yolo Basin, 1,185 acres of managed wetland habitat would be permanently converted; 1,066 acres of which are protected. In addition, 42 acres of managed wetland habitat would be temporarily lost by construction-related activities associated with tidal restoration (CM4) and fisheries enhancement activities (CM2). Increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could periodically affect managed wetlands ranging from an estimated 643 acres during a notch flow of 1,000 cfs to an estimated 2,055 acres during a notch flow of 4,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*) in the Yolo Basin.

Delta Basin: Within the Delta Basin, 90 acres of managed wetland habitat would be permanently converted, as a result of tidal restoration (CM4). Thirteen of the 90 acres are protected (Table 3, ICF International 2013). Periodic flooding would not affect this natural community type in Delta Basin.

Suisun Basin: Within the Suisun Basin, 11,532 acres of managed wetland habitat would be permanently converted as a result of tidal restoration (CM4); 10,354 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (*Charadrius semipalmatus*), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

Managed wetlands would decrease in overall extent by 20% (Table 5, ICF International 2013). Most of this loss would occur in Suisun with some additional acreage loss in the Yolo Basin. The loss of managed wetland habitat for covered species and waterfowl would be compensated for with 8,200 acres remaining managed wetland protection in Suisun Marsh. Of these 8,200 acres, the 5,000 acres of seasonal wetland protected, enhanced, and managed to provide overwintering waterfowl foraging habitat would be the habitat type most likely to benefit overwintering shorebirds. However, the 1,600 acres of semi-permanent and permanent managed wetlands for breeding waterfowl and 1,500 acres of managed wetlands for salt marsh harvest mouse would also be expected to have some benefit to wintering and breeding shorebirds.

Cultivated Lands

Yolo Basin: Primarily as a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 8,309 acres of cultivated lands would be permanently converted; 1,272 acres of which are protected. Also within the Yolo Basin, increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could affect an estimated 3,219 acres of cultivated lands during a notch flow of 1,000 cfs to an estimated 5,512 acres during a notch flow of 6,000 cfs (Table 5.4-2 in BDCP Chapter 5, *Effects Analysis*).

Delta Basin: Within the Delta Basin, as a result of tidal restoration (CM4) and floodplain restoration (CM5), 25,633 acres of cultivated lands would be permanently converted. There would also be an additional 112 acres lost temporarily due to CM5 activities. Of the total permanently converted lands, 3,925 acres are protected (Table 3, ICF International 2013). Seasonal flooding (CM5) on the restored floodplain would periodically affect 738 acres of cultivated lands in Delta.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Cultivated land loss would occur in all three basins, but the majority of acreage loss would occur in the Delta basin. Pasture crop types would decrease in overall extent by 15% over baseline (Table 5, ICF International 2013), but would increase in protection by 135%. More than half of all cultivated lands within the 48,000-acre BDCP cultivated lands reserve would be in pasture production (primarily alfalfa) and enhanced and managed to benefit Swainson's hawk. Idle crop types are not identified as a specific conservation target in the BDCP, are expected to occur within the reserve and are recognized in the BDCP as having "moderate" foraging habitat value for Swainson's hawk, white-tailed kite, and greater sandhill crane.

Grain and hay crop would be expected to decrease by 13% (Table 5, ICF International 2013) while protection, enhancement and management would be expected to increase by 28% (Table 6, ICF International 2013). These crop types would be managed for a tricolored blackbirds, Swainson's hawk, white-tailed kite, greater sandhill crane, and burrowing owls.

Rice would decrease in overall extent by 2% (Table 5, ICF International 2013) but increase in total protection by 57%. Rice lands would be protected, enhanced, and managed for the benefit for giant garter snake.

Tidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 194 acres of tidal wetland habitat would be permanently converted; 180 acres of which are protected. In addition, 12 acres of tidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass would affect 3,957 acres of tidal wetlands in Yolo Basin.

Delta Basin: Within the Delta Basin, 54 acres of tidal wetlands would be permanently converted as a result of tidal restoration (CM4) (Table 3, ICF International 2013). Of the total permanently converted lands, 26 acres are protected. Periodic flooding in Yolo Bypass would affect 26 acres of tidal wetlands in Delta Basin.

Suisun Basin: Within the Suisun Basin, 219 acres of tidal wetland habitat would be permanently converted as a result of tidal restoration (CM4); 215 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

Tidal mudflat habitat would be estimated to increase in extent by 1,780 acres. This extremely large increase in tidal mudflat habitat would occur almost exclusively in Suisun Marsh as the result of tidal restoration and the conversion of existing mid- and high-marsh types to low marsh and tidal mudflats in response to sea level rise. BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, details the methods and assumptions modeled to come about this result. Tidal mudflat habitats would be expected to require management, however, sediment augmentation has been discussed as an experimental method that could be employed in places like Suisun to combat the loss of intertidal marshes in the face of sea level rise and reduced sediment supplies.

Tidal emergent wetland habitat would increase in extent by 152% (Table 5, ICF International 2013). Of the 30,000 acres of emergent wetland restoration, 6,000 acres would be in the Suisun Basin and the rest would be distributed between the Yolo and Delta Basins. Enhancement and management on these lands would be likely to be focused on nonnative, invasive species management. Any additional actions in Suisun would be focused on salt marsh harvest mouse, Suisun shrew, California clapper rail, black rail, Suisun thistle, and soft bird's-beak. In freshwater marshes, enhancement and management would be likely to focus on black rail, western pond turtle, and, in some cases, giant garter snake.

Nontidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 313 acres of nontidal wetland habitat would be permanently converted; 119 acres of which are protected. In addition, 11 acres of nontidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2)

(Table 2, ICF International 2013). Periodic flooding in Yolo Bypass associated with ongoing Fremont Weir operation (CM2) would affect 305 acres of nontidal wetlands in Yolo Basin, specifically nontidal perennial aquatic habitat.

Delta Basin: Within the Delta Basin, 99 acres of nontidal wetlands would be permanently converted as a result of tidal restoration (CM4) and floodplain restoration (CM5) (Table 3, ICF International 2013). There would also be 8 acres of nontidal perennial aquatic habitat temporarily lost from CM5 activities. Of the total permanently converted lands, 29 acres are protected. Periodic flooding from CM5 would affect 4 acres of nontidal perennial aquatic habitat in Delta Basin.

Suisun Basin: Within the Suisun Basin, 1 acre of nontidal wetland habitat, specifically vernal pool complex, would be permanently converted as a result of tidal restoration (CM4); and is not protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2010, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

Nontidal freshwater emergent wetland would increase in extent by 88% as a result of BDCP implementation (Table 5, ICF International 2013). These lands would be managed to benefit giant garter snake and located within the Delta Basin (likely in the vicinity of White Slough) and the Yolo Basin (in the Cache Slough area).

Impacts on wetted acres of vernal pool complex and alkali seasonal wetland complex would be avoided and thus loss of this community is not expected. However, up to 10 acres of wetted acre loss could be permitted under the Plan. Protection of vernal pool complex natural community would increase by 13% and by 6% for alkali seasonal wetlands (Table 6, ICF International 2013). Protection of these two community types would enhance and manage habitat for vernal pool crustaceans and alkali-related plant species.

The protection and restoration of natural communities would also include management and enhancement actions under *CM11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under CM11, in areas where they would not conflict with covered species management.

- Managed Wetlands
    - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
    - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.

- Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
- Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
- Create low slopes on islands and levees; gradual angles (10-12:1) are better than steep angles.
- Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
- Potentially add material to levees or to islands to encourage nesting for some species.

- Cultivated Lands
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July- September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
  - Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).
  - Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April- July, Iglecia et al. 2012).
  - Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
  - When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
  - Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
  - Maintain gently sloping levees and island sides (10-12:1; Iglecia et al. 2012).

- Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

***NEPA Effects*:** Alternative 1C implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be substantial loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While substantial losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for the loss of substantial acreage, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

***CEQA Conclusion*:** Alternative 1C implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be significant loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While significant losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for substantial acreage loss, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other conservation actions. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight-diverters on new transmission lines, and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect shorebirds and waterfowl, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on shorebirds and waterfowl.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of Alternative 1C water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 1C implementation would not have an adverse effect on shorebirds and waterfowl. Tidal habitat restoration is unlikely to have an adverse effect on shorebirds and waterfowl through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds, and the potential for increased exposure would vary substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management*, would address the uncertainty of methylmercury levels in restored tidal marsh. Once site-specific sampling and other information is developed, the site-specific planning phase of marsh restoration would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury.

***CEQA Conclusion*:** Noise, potential hazardous spills, and increased dust and sedimentation as a result of Alternative 1C water conveyance facilities construction and operation and maintenance would have a significant impact on shorebirds and waterfowl. AMM1–AMM7 would minimize these impacts, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the impacts to a less-than-significant level. Tidal habitat restoration is unlikely to have a significant impact on shorebirds and waterfowl species through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds. Site-specific restoration plans that address the creation and mobilization of mercury, as well as the monitoring and adaptive management described in CM12, would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury in the study area. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 1C implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not covered under laws or regulations that address conservation or protection of individual species. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in the analysis of Alternative 1C effects on natural communities (Impacts BIO-1 through BIO-31). In general, effects on habitat of common wildlife and plants would not be adverse because effects would be greatly offset by protection, restoration and other conservation activities contained in the BDCP, including *CM3 Natural Communities Protection and Restoration*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3B, *Environmental Commitments, AMMs, and CMs,* are in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing Alternative 1C conservation measures would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife, including increased traffic on local roads from construction vehicles that could increase wildlife mortalilty and impede wildlife movement. Effects of construction traffic on wildlife moving in the vicinity of Stone Lakes NWR would be minimized by *AMM20 Greater Sandhill Crane*, which includes a measure for the installation of a vegetation screen or other noise and visual barrier along Hood Frankling Road for the benefit of cranes, which would be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and would provide a continuous surface impenetrable by light. This measure would potentially direct wildlife wishing to cross Hood Franklin Road toward the overcrossing of the canal that links the Stone Lakes properties (just east of the town of Hood). The overcrossing includes strips of terrestrial habitat on either side of the canal.

Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors, fugitive dust, runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants or noxious weeds).

NEPA Effects: The effects of constructing water conveyance facilities and restoring tidal and other habitats associated with Alternative 1C would not be adverse to common wildlife and plants because conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities would result in avoiding and minimizing effects on common wildlife and plants as well.

CEQA Conclusion: Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by common wildlife and plant species. Conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of Alternative 1C is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

Essential Connectivity Areas (ECAs) are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effect of BDCP Conservation Measures on Wildlife Corridors

Alternative 1C water conveyance facilities would cross one of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA. The conveyance facilities would also cross one landscape linkage identified in the BDCP, the *West to Contra Costa County* linkage (#2 in Figure 12-2). Though the conveyance facilities shown on Figure 12-2 overlap with the line representing the *Yolo Bypass* (#3 in Figure 12-2) and the *Sacramento River* linkage (#9 in Figure 12-2) these lines generally represent the course of the flooded Yolo Bypass and Sacramento River, respectively, and are intended to address the needs of fish species and will thus not be addressed in this chapter.

The construction of Intakes 1 and 2 and associated borrow/spoils areas near Clarksburg would occur within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the Sacramento River and the permanent and temporary loss of agricultural lands. These habitat losses would not substantially impede the movement of any wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento Deep Water Shipping Channel already create a barrier to dispersal for nonavian species and the loss of the narrow strips of riparian vegetation and agricultural lands would not impede the movement of bird species between these areas. Though the loss of the narrow strips of riparian vegetation and cultivated lands would not substantially impede the movement of bird species between these areas the addition of new transmission lines could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes (see impact discussions for greater and lesser sandhill cranes). One record for Swainson's hawk would be affected by a borrow/spoils area. These effects are addressed in the Swainson's hawk effects analysis.

In general, the Alternative 1C conveyance canal would create a substantial barrier to the movement of nonavian terrestrial wildlife from north to south in CZ 3 from Hood west to the Sacramento Deep Water Ship Channel, from east to west where the canal turns to the south to where the canal flows into the pipeline, and another barrier from east to west from where the pipeline spills into the canal east of Oakley south to where the canal would flow into the Byron Tract Forebay. There are records of Swainson's hawk, burrowing owl, and pond turtle that would be impacted by the canal but would not likely isolate any known populations of special-status species (California Department of Fish and Wildlife 2013). Transmission lines associated with this alternative could also affect the movement of avian species during periods of low visibility. Sandhill cranes are known to roost in the vicinity of a few of the lines, yet in general these lines are further to the west of the major roost sites and likely flight paths.

The Alternative 1C canal, work areas, and potential borrow and spoils area cross the *West to Contra Costa County* linkeage just west of Clifton Court Forebay. This linkage was established to guide restoration and protection to provide habitat connectivity for vernal pool and alkali seasonal wetland species, California red-legged frog, California tiger salamander, and San Joaquin kit fox between the Plan Area and lands protected to the west in East Contra Costa County. The construction of these conveyance features would impact habitat and known populations vernal pool fairy shrimp, California tiger salamander, and California red-legged frog. The canal would not be a barrier for species moving from Clifton Court Forebay to the west because it is right up against the forebay but would remove and impact populations that are linked to populations to the west. The temporary work area on the west side of Italian Slough, where there is a record for California red-legged frog, would not serve as permanent barrier between this population and ones to the west.

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

***NEPA Effects*:** Despite the contributions from restoration and protection activities, Alternative 1C would create a substantial barrier to the movement of nonavian terrestrial wildlife in the central portion of the study area and the east-west movement of wildlife in south-central Delta to the west, and create barriers to safe movement of avian species during periods of low visibility. Alternative 1C would adversely affect wildlife corridors within the study area.

***CEQA Conclusion*:** Alternative 1C water conveyance facilities would create a substantial barrier to the movement of nonavian terrestrial wildlife from north to south in CZ 3 from Hood west to the Sacramento Deep Water Ship Channel, from east to west where the canal turns to the south to where the canal flows into the pipeline, and another barrier from east to west from where the pipeline spills into the canal east of Oakley, south to where the canal would flow into the Byron Tract Forebay. There are records of Swainson's hawk, burrowing owl, and pond turtle that would be impacted by the canal but would not likely isolate any known populations of special-status species (California Department of Fish and Wildlife 2013). Transmission lines associated with this alternative could also affect the movement of avian species during periods of low visibility. Sandhill cranes are known to roost in the vicinity of a few of the lines, yet in general these lines are further to the west of the major roost sites and likely flight paths.

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

Despite the contributions from restoration and protection activities, Alternative 1C would create a substantial barrier to the movement of nonavian terrestrial wildlife the central portion of the study area and create barriers to safe movement of avian species during periods of low visibility. Alternative 1C would result in significant unavoidable impacts on wildlife corridors within the study area. There is no practicable mitigation measure to reduce this impact to a less-than-significant level.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities covered under the BDCP could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of the BDCP are:

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.
- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from:

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, reusable tunnel material, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-1C-70 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 1C of the BDCP.

Table 12-1C-70. Summary of Temporary Disturbance in Natural Communities under Alternative 1C

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	133
Tidal brackish emergent wetland	0
Tidal freshwater emergent wetland	2
Valley foothill riparian	209
Grassland	594
Inland dune scrub	0
Alkali seasonal wetland complex	9
Vernal pool complex	37
Other natural seasonal wetland	2
Nontidal freshwater perennial emergent wetland	6
Nontidal perennial aquatic	48
Managed wetlands	189
Cultivated lands	11,038
Total	**12,267**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Under Alternative 1C, the BDCP would have adverse effects on natural communities from the introduction and spread of invasive plant species through implementation of CM1–CM10 and AMM6. No adverse effects are expected from implementation of CM11–CM21.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 1C water conveyance facilities would result in the temporary disturbance of 10,224 acres that would provide opportunities for colonization by invasive plant species.
- *CM2 Yolo Bypass Fisheries Enhancements:* Construction of the Yolo Bypass fisheries enhancements would result in the temporary disturbance of 758 acres that would provide opportunities for colonization by invasive plant species. Vegetation maintenance activities for the Fremont Weir and Yolo Bypass improvements may include the removal of giant reed; however, the clearing of linear areas to facilitate water flow may also result increased opportunities for invasion. Sediment removal, transportation, and application as a source material for restoration or levee projects as part of Fremont Weir and Yolo Bypass maintenance activities could also result in the spread of invasives if the sediment contains viable invasive plant propagules.
- *CM3 Natural Communities Protection and Restoration:* The restoration activities in the natural communities located in the eleven CZs would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.

- *CM4 Tidal Natural Communities Restoration:* The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the BDCP Implementation Office would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the BDCP Implementation Office would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration levee construction would result in the temporary disturbance of 1,285 acres along channels in the north, east, and south Delta (San Joaquin, Old, and Middle Rivers) that would provide opportunities for colonization by invasive plant species.
- *CM6 Channel Margin Enhancement:* The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.
- *CM7 Riparian Natural Community Restoration:* The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *CM8 Grassland Natural Community Restoration:* The restoration of grassland habitat in CZs 1, 8 and/or 11 would result in the temporary disturbance of degraded grassland or cultivated land that would provide opportunities for colonization by invasive plant species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* The restoration of vernal pool and alkali seasonal wetland complexes in CZs 1, 8, or 11 would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration, which would take place through conversion of agricultural lands in CZs 2 and 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.
- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoil, reusable tunnel material, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of CM11, AMM4, AMM10, and AMM11.

CM11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the BDCP reserve system to reduce competition on native species, thereby improving conditions for covered species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4 and AMM10 in CM21 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would include the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would include methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the BDCP Implementation Office would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the other CMs, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any BDCP restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the Plan Area. Cleaning stations would be established at the perimeter of BDCP covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

NEPA Effects: The implementation of AMM4, AMM10, AMM11, and CM11 under Alternative 1C would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

CEQA Conclusion: Under Alternative 1C, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing Alternative 1C would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be less-than-significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Conservation Measures with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities (CM1) and implementing CM2–CM21 for Alternative 1C have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 1C would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 1C on terrestrial biological resources are addressed in the discussions of impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the BDCP.

Federal and State Legislation

- The federal *Clean Water Act*, *Endangered Species Act*, *Fish and Wildlife Coordination Act*, *Migratory Bird Treaty Act*, *Rivers and Harbors Act* and *Marine Mammal Protection Act* all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decisionmaking. The biological goals and objectives contained in the BDCP that provide the major guidance for implementing the various conservation elements of Alternative 1C are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the Plan Area. While some of the conservation measures of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term guidance in the Plan would provide for the long-term viability and expansion of the habitats and special-status species populations in the Plan Area. Alternative 1C conservation actions would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.
- The *California Endangered Species Act*, *California Native Plant Protection Act*, *Porter-Cologne Water Quality Control Act*, and *Natural Communities Conservation Planning Act* are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. The BDCP, which is the basis for Alternative 1C, contains biological goals and objectives that have been developed to promote

the species protection and natural resource conservation that are directed by these state laws. Alternative 1C conservation actions would be compatible with the policies and directives contained in these laws.

- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (Delta Protection Act) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are BDCP proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The BDCP biological goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).

- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. The BDCP and its plans for protection and restoration of tidal marsh habitats in Suisun Marsh would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The BDCP is intended to become a component of the Delta Plan. The Delta Stewardship Council will determine whether the BDCP is compatible with the goals and objectives of the Delta Plan prior to its incorporation into the Plan. The compatibility of the BDCP with the Delta Plan is considered in detail in Section 13.2.2.2 of Chapter 13, *Land Use*.

- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. The Alternative 1C conservation measures that provide for a significant expansion of wetland acreage and quality in the Delta and Suisun Marsh would be compatible with the intent of the California Wetlands Conservation Policy.

- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The BDCP Plan Area includes all or portions of three Implementation Plan basins—the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

Implementation of the Alternative 1C conservation measures would result in significant reductions in cultivated land and managed wetland acreage in the Delta, Yolo and Suisun basins; however, significant increases in tidal and nontidal wetlands in these basins would be another result. Because of the large conversion of managed wetland in the Suisun basin, the BDCP has included a large managed wetland conservation and enhancement goal for this area. For the Suisun basin conversions to be compatible with the 2006 Implementation Plan goals, this EIR/EIS has added mitigation that would require food production studies and adaptive management to ensure that the Suisun basin would continue to provide the waterfowl and shorebird habitat envisioned in the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, *Yolo Bypass Wildlife Area Land Management Plan*, *Grizzly Island Wildlife Area Management Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 1C, especially construction of CM1 and CM2 facilities, and land modification associated with CM4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the BDCP would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Yolo Bypass, on Sherman Island, and in Suisun Marsh would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. The SMPA was signed in 1987 and modified in 2005 by DWR, CDFW, Reclamation and the Suisun Resource Conservation District to establish the mitigation approach in the Marsh for effects of operating the SWP and CVP. The primary concerns were the effects of CVP and SWP Delta diversions on salinity in the Marsh. The SMPA focused on ways to ensure adequate water quality and quantity for the managed wetlands and wildlife habitats in the Marsh to assure equal waterfowl values in the Marsh. The Suisun Marsh Plan, for which a Final EIS/EIR was released in 2010 by these agencies, provides for restoration of tidal marsh habitat and enhancement of managed wetland in the Marsh, maintenance of waterfowl hunting and recreational opportunities in the Marsh, maintenance and improvement of the Marsh levee system, and protection and enhancement of water quality for beneficial uses of the Marsh. An integral component of the Suisun Marsh Plan is balancing continued managed wetland operation with new tidal wetland restoration to provide improved and greater habitat for fish and wildlife species. The Suisun Marsh Plan is a programmatic, long-term plan and does not include specific projects, project proponents, or funding mechanisms. However, the Suisun Marsh Plan relies on tidal restoration to allow for managed wetland operations to continue. The BDCP would provide a funding mechanism and increased management potential relative to existing and restored habitats, assisting the Suisun Marsh Plan in meeting its broader ecological goals, consistent with long-term operation of the SWP and CVP water conveyance facilities. The conservation actions contained in Alternative 1C, which are designed to ensure the long-term protection and recovery of special-status fish and wildlife species dependent on the Marsh, would be compatible with the water quality and habitat restoration goals of the SMPA and Suisun Marsh Plan.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the Plan's long-term control and management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that Plan objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of BDCP's conservation actions would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 1C would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.
- *Habitat Conservation Plans* and *Natural Community Conservation Plans* are the subject of a detailed analysis at the end of this chapter. The analysis considers the compatibility of the BDCP with all HCPs and NCCPs that share planning area with the BDCP Plan Area.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The BDCP proposes to protect, enhance and expand the wetlands of the Plan Area, and, therefore, would be compatible with Executive Order 11990.
- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 1C construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of mitigation measures described in this chapter would be capable of making Alternative 1C implementation compatible with Executive Order 13112.
- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 1C conservation measures that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion conservation measures of Alternative 1C would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

CEQA Conclusion**:** The potential plan and policy incompatibilities of implementing Alternative 1C identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of large acreages of cultivated lands and managed wetland to natural wetland and riparian habitat in the Plan Area. The physical effects are discussed in the *Shorebirds and Waterfowl* analysis above and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2.3 of Chapter 13, *Land Use*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations and the relationship between plan and policy consistency and physical consequences to the environment.

12.3.3.5 Alternative 2A—Dual Conveyance with Pipeline/Tunnel and Five Intakes (15,000 cfs; Operational Scenario B)

Alternative 2A, which is described in Section 3.5.5 in Chapter 3, *Description of Alternatives*, and depicted in Figure 3-2, would affect terrestrial biological resources in a nearly identical fashion to Alternative 1A. For this reason, Alternative 2A is considered here in a summary fashion; the reader is referred to the discussion of Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 2A, and to Table 12-ES-1 for a summary comparison of natural community effects of Alternatives 1A and 2A. The impacts associated with Alternatives 1A and 2A were derived by comparing the alternative with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Comparative Differences in CM1 Construction Effects for Alternatives 1A and 2A

The principal differences in effect between these two alternatives are related to the differing construction footprints of the water conveyance facilities (CM1). The Alternative 2A water conveyance facilities could entail construction at north Delta Intakes 6 and 7 rather than 4 and 5. The locations of these intakes are depicted in Figure 3-2. Intakes 6 and 7 are located farther south on the Sacramento River, south of Sutter and Steamboat Sloughs. The analysis in this section assumes use of Intakes 6 and 7. The operational scenario for Alternative 2A (Scenario B) is also different from Alternative 1A (Scenario A), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area. Alternative 2A operations would involve placement of a permanent in-stream operable barrier at the head of Old River in the south Delta and increased Delta freshwater outflows during September through November of some water years. All of the conservation measures other than CM1 would be the same as under Alternative 1A.

Due to the change in location of the two intakes and their associated pumps and pipelines, Alternative 2A would create minor differences in the permanent and temporary loss of natural communities and cultivated lands during water conveyance facilities construction when compared with Alternative 1A (Table 12-2A-1). All of these differences would occur during the near-term timeframe associated with water facilities construction. Alternative 2A would permanently remove 3 fewer acres of valley/foothill riparian habitat along the Sacramento River, 7 acres more of grassland and 14 acres more of cultivated land in the same area when compared with Alternative 1A. Alternative 2A would also permanently affect a larger acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (2 acres more; see Table 12-2A-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

During the water conveyance facilities construction process, Alternative 2A would involve slightly more temporary loss of habitat when compared with Alternative 1A because of the lengthy pipelines needed to serve Intakes 6 and 7. The differences would include cultivated lands east of the river (492 acres more), tidal perennial aquatic within the river channel (7 acres more), valley/foothill riparian along the river levee (4 acres more), and grassland along the river levee (9 acres more; see Table 12-2A-1). Alternative 2A would also temporarily affect a larger acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (20 acres more; see Table 12-2A-2).

Note that the acres of habitat affected by CM1, as listed in Table 12-2A-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-2A-3 and Table 12-2A-4 for other conservation actions are for the late long-term timeframe; the numbers represent acres affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community protection and restoration conservation measures over the course of the BDCP.

These mostly minor differences in permanent loss of habitat associated with constructing CM1 would create minor differences in effects on covered and noncovered wildlife. The small increase in permanent loss of cultivated land (primarily alfalfa and irrigated pasture) associated with Alternative 2A would result in a slightly larger loss of foraging habitat for species such as tricolored blackbird, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark. Alternative 2A would also increase the loss of low- and moderate-value habitat for western burrowing owl. The reduced level of valley/foothill riparian habitat loss would be a positive influence on breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, Cooper's hawk, white-tailed kite and black-crowned night heron), and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. The larger temporary losses of cultivated land, grassland and valley/foothill riparian natural communities associated with Alternative 2A would have near-term effects on the special-status species that use these communities. There would be 241 more acres of foraging habitat temporarily lost under Alternative 2A for greater sandhill crane when compared to Alternative 1A because of the cultivated land loss. However, the effects would be offset in the near-term by AMMs adopted for specific species, including greater sandhill crane, and over time by on-site restoration required by *AMM10 Restoration of Temporarily Affected Natural Communities*.

The differences in effect that constructing CM1 for Alternatives 1A and 2A could have on special-status plant species are extremely minor. Habitat modeling indicates that Alternative 2A would permanently remove 1 less acre of side-flowering skullcap habitat and permanently remove one more acre of both Mason's lilaeopsis and delta mudwort habitat when compared with Alternative 2A.

The near-term conservation activities described and evaluated in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for protection, enhancement and restoration of habitats affected by the near-term water conveyance facilities construction activities. This conservation activity, which is part of the early implementation of the BDCP, would offset water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Table 12-2A-1. Alternative 2A Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)[a]

Natural Community	Total Existing Habitat in Study Area	Conveyance Option			
		Alternative 2A Removed Habitat (Permanent)[c]	Difference from Alternative 1A	Alternative 2A Removed Habitat (Temporary)[d]	Difference from Alternative 1A
Tidal perennial aquatic[b]	86,263	48	0	140	+7
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	5	-1
Valley/foothill riparian	17,966	55	-3	32	+4
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	322	+7	271	+9
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	3,850	+14	2,683	+492

[a] Acreages in this table assume Alternative 2A would use north Delta Intakes 6 and 7, not 4 and 5. Impacts of 4 and 5 are addressed in Alternative 1A.

[b] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[c] Features in this category include the following conveyance-related facilities: Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[d] Features in this category include the following construction-related work areas: Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, Borrow/Spoil Area.

Table 12-2A-2 Alternative 2A Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1A (acres)

	Alternative 2A Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1A	Temporary Impact	Difference from Alternative 1A
Agricultural Ditch	65.8	0.9	32.6	9.1
Alkaline Wetland	0.1	0.0	0	0.0
Clifton Court Forebay	1.0	0.0	0	0.0
Conveyance Channel	12.7	0.0	1.1	0.0
Depression	1.9	0.0	1.8	0.0
Emergent Wetland	46.8	0.0	6.7	-0.6
Forest	6.4	0.6	15.6	3.6
Lake	0.2	0.2	2.3	2.0
Scrub-Shrub	18.2	-2.4	2.4	-1.9
Seasonal Wetland	18.7	0.0	29.2	2.6
Tidal Channel	45.8	2.9	139.1	5.3
Vernal Pool	0	0.9	0	9.1
Total	**218**	**2.3**	**231**	**20.1**

Effects of Restoration-Related Conservation Actions of Alternative 2A

The reader is referred to the Alternative 1A impact analysis above for the broader discussion of overall terrestrial biological resources effects that would result from implementation of restoration-related conservation measures under Alternative 2A. The principal effects of concern associated with both Alternative 1A and 2A are related to the conversion of large acreages of primarily cultivated lands, managed wetland, grassland and valley/foothill riparian habitat to tidal and other natural communities (CM2, CM4, CM5, CM7, CM8, CM10, and CM18; Table 12-2A-3 and Table 12-2A-4). These effects accrue to special-status species and common wildlife species, especially those that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activity (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Table 12-2A-3. Alternative 2A Late Long-term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-2A-4. Alternative 2A Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

Some of the permanent habitat loss associated with the restoration components of these alternatives would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal perennial aquatic, tidal brackish emergent wetland and tidal freshwater emergent wetland natural communities. The BDCP conservation components, including the restoration components (CM2-CM10), are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. Similar benefits would accrue to noncovered special-status species and common wildlife in the study area.

NEPA Effects: Alternative 2A would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 2A would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

CEQA Conclusion: Alternative 2A would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 2A would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

As with Alternative 1A, Alternative 2A would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 2A AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat

- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.6 Alternative 2B—Dual Conveyance with East Alignment and Five Intakes (15,000 cfs; Operational Scenario B)

Alternative 2B, which is described in Section 3.5.6 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-4, would affect terrestrial biological resources in a similar fashion to Alternative 1B. For this reason, Alternative 2B is considered here in a summary fashion; the reader is referred to Alternative 1B for a detailed description of impacts that would be associated with implementing Alternative 2B, and to Table 12-ES-1 for a summary comparison of natural community effects of Alternatives 1B and 2B. The impacts associated with Alternatives 1B and 2B were derived by comparing the alternatives with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Comparative Differences in CM1 Construction Effects for Alternatives 1B and 2B

The principal differences between these two alternatives are related to the differing construction footprints of the water conveyance facilities (CM1). The Alternative 2B water conveyance facilities could entail construction at north Delta Intakes 6 and 7 rather than 4 and 5. The locations of these intakes are depicted in Figure 3-2. Intakes 6 and 7 are located farther south on the Sacramento River, south of Sutter and Steamboat Sloughs. This location change results in longer pipeline construction to move water from the Sacramento River to the East Canal. The analysis in this section assumes use of Intakes 6 and 7. The operational scenario for Alternative 2B (Scenario B) is also different from Alternative 1B (Scenario A), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area. Alternative 2B operations would involve placement of a permanent operable barrier at the head of Old River in the south Delta and increased Delta freshwater outflows during September, October, and November of some water years. All of the conservation measures other than CM1 would be the same as under Alternative 1B.

Due to the change in location of the two intakes and their associated pumps and pipelines, Alternative 2B would create minor differences in permanent and larger differences in temporary loss of natural communities and cultivated lands during water conveyance facilities construction when compared with Alternative 1B (Table 12-2B-1). All of these differences would occur in the near-term timeframe associated with water facilities construction. Alternative 2B would permanently remove 3 fewer acres of valley/foothill riparian habitat along the Sacramento River and 1 fewer acre of cultivated land (primarily alfalfa and irrigated pasture) just east of the river. When compared with Alternative 1B, Alternative 2B would permanently remove 6 acres more of grassland and 1 acre more of tidal perennial aquatic natural community along the eastern bank of the river at intake sites. Alternative 2B would also permanently affect a larger acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1B (3 acres more; see Table 12-2B-2). Refer to Table 12-1B-69 for a summary of Alternative 1B permanent and temporary jurisdictional waters and wetlands impacts.

Table 12-2B-1. Alternative 2B Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)[a]

		Conveyance Option			
Natural Community	Total Existing Habitat in Study Area	Alternative 2B Removed Habitat (Permanent)[c]	Difference from Alternative 1B	Alternative 2B Removed Habitat (Temporary)[d]	Difference from Alternative 1B
Tidal perennial aquatic[b]	86,263	34	+1	171	+26
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	8	0	16	+5
Valley/foothill riparian	17,966	48	-3	56	+17
Nontidal perennial aquatic	5,567	19	0	5	0
Nontidal freshwater perennial emergent wetland	1,509	5	0	7	+1
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	4	0	0	0
Managed wetland	70,798	6	0	20	+2
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	406	+6	382	+24
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	7,885	-1	13,047	+496

[a] Acreages in this table assume Alternative 2B would use north Delta Intakes 6 and 7, not 4 and 5. Impacts of 4 and 5 are addressed in Alternative 1B.

[b] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[c] Features in this category include the following conveyance-related facilities: Canal, Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Storage Areas.

[d] Features in this category include the following construction-related work areas: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas

Table 12-2B-2 Alternative 2B Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1B (acres)

	Alternative 2B Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1B	Temporary Impact	Difference from Alternative 1B
Agricultural Ditch	228.2	0.3	38.5	7.4
Alkaline Wetland	0.1	0	0	0
Clifton Court Forebay	1.0	0	0	0
Conveyance Channel	12.7	0	1.1	0
Depression	35.1	0	1.9	0
Emergent Wetland	77.8	0.2	23.8	3.8
Forest	9.9	0.7	13.7	6.7
Lake	0.2	0	0	-0.3
Scrub-Shrub	11.4	-2.4	11.0	-1.2
Seasonal Wetland	177.7	0.2	4.1	4.1
Tidal Channel	31.9	3.9	174.7	28.4
Vernal Pool	0	0	0	0
Total	**586**	**2.8**	**269**	**49.0**

During the water conveyance facilities construction process, Alternative 2B would involve significantly more temporary loss of tidal perennial aquatic habitat (26 acres), valley/foothill riparian habitat (17 acres) and grassland (24 acres). These temporary losses would occur primarily along Snodgrass Slough and the north-south irrigation canal just east of the slough. The Alternative 2B pipelines would also temporarily affect greater acreages of cultivated land (496 acres more), including alfalfa, vineyard, orchard and other cultivated cropland. There would be much smaller differences in the acreage of temporary effect on managed wetland and tidal freshwater emergent wetland (Table 12-2B-1). Alternative 2B would also temporarily affect a larger acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1B (49 acres more; see Table 12-2B-2).

Note that the acres of habitat affected by CM1, as listed in Table 12-2B-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-2B-3 and Table 12-2B-4 for other conservation actions are for the late long-term timeframe; the numbers represent acres affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community protection and restoration conservation measures over the course of the BDCP.

The mostly minor differences in permanent loss of habitat associated with constructing CM1 would create minor differences in effects on covered and noncovered wildlife species. The small reductions in permanent loss of alfalfa and irrigated pasture associated with Alternative 2B would result in a slightly smaller loss of foraging habitat for species such as tricolored blackbird, Swainson's hawk and white-tailed kite. Alternative 2B would result in a slightly smaller permanent loss (20 acres) of crane foraging habitat compared to Alternative 1B. Alternative 2B would also reduce the loss of low- and moderate-value habitat for western burrowing owl. The reduced level of valley/foothill riparian habitat loss would be a positive influence on breeding habitat for raptors and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo.

The larger acreages of temporary losses of tidal perennial aquatic and tidal freshwater emergent wetland habitat would affect a number of wetland habitat-dependent birds and reptiles, including tricolored blackbird, least bittern, giant garter snake and western pond turtle. Construction across Snodgrass Slough and the adjacent irrigation canal could disrupt both foraging and migration activities of giant garter snake. The temporary losses of valley/foothill riparian habitat would affect roosting and nesting habitat for bird species such as Swainson's hawk, white-tailed kite, great egret, snowy egret, great blue heron, Cooper's hawk, and black-crowned night heron. Temporary losses of grassland between the Sacramento River and the East Canal would reduce foraging habitat for species such as short-eared owl, northern harrier, mountain plover, California horned lark, and greater sandhill crane. Grassland loss would also reduce refugia for giant garter snake. The temporary losses in cultivated acreage, especially alfalfa and other cultivated cropland, would reduce foraging habitat for species such as Swainson's hawk, greater sandhill crane, short-eared owl, mountain plover, and loggerhead shrike. There would be 214 more acres of foraging habitat temporarily lost under Alternative 2B for greater sandhill crane when compared to Alternative 1B because of the cultivated land loss. However, the effects of Alternative 2B would be offset in the near-term by AMMs adopted for specific species, including greater sandhill crane, and over time by on-site restoration required by *AMM10 Restoration of Temporarily Affected Natural Communities*.

The differences in effect that constructing CM1 for Alternatives 1B and 2B could have on special-status plant species are extremely minor. Habitat modeling indicates that Alternative 2B would create 1 less acre of permanent loss of side-flowering skullcap habitat and 1 acre more of temporary loss for the same plant. For both delta mudwort and Mason's lilaeopsis, Alternative 2B would permanently remove 1 more acre and temporarily remove 4 more acres of habitat compared to Alternative 1B. The near-term conservation activities discussed in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for conservation, enhancement and replacement of habitats affected by the early water conveyance facility construction activities. This conservation activity, which is part of the early implementation of the BDCP, would offset water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Effects of Restoration-Related Conservation Actions of Alternative 2B

The reader is referred to the Alternative 1B impact analysis above for the broader discussion of overall terrestrial biological resources effects that would result from implementation of restoration-related conservation measures under Alternative 2B. The principal effects of concern associated with both Alternatives 1B and 2B are related to the conversion of large acreages of cultivated lands, managed wetland, grassland and valley/foothill riparian habitat to tidal marsh and other habitat types(CM2, CM4, and CM5; Table 12-2B-3 and CM7, CM8, CM10, and CM18; Table 12-2B-4). These effects accrue to special-status species and common wildlife species, especially those that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activity (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Table 12-2B-3. Alternative 2B Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-2B-4. Alternative 2B Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

Some of the permanent habitat loss associated with the restoration components of these alternatives would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal freshwater emergent wetland, tidal brackish emergent wetland) and other natural communities. The BDCP conservation components, including restoration components (CM2-CM10) are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

NEPA Effects: Alternative 2B would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area except for an adverse effect on giant garter snake population connectivity and on wildlife movement corridors in general. The construction of the canal would substantially inhibit the movement of giant garter snakes and other wildlife from moving within and outside of the Delta. This alternative would not significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1B, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of the water conveyance canal from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize adverse effects to the maximum extent practicable. Alternative 2B would not require mitigation measures beyond what is proposed for Alternative 1B to offset effects.

CEQA Conclusion: Alternative 2B would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area except for giant garter snake habitat connectivity and wildlife movement corridors in general. The construction of the canal would substantially inhibit the movement of giant garter snakes and other wildlife from moving within and outside of the Delta. The alternative would not increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1B, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize significant impacts. Alternative 6B would not require mitigation measures beyond what is proposed for Alternative 1B to offset effects. Despite these measures, there would remain significant and unavoidable impacts on giant garter snake population connectivity and wildlife movement corridors from Alternative 2B.

As with Alternative 1B, Alternative 2B would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 2B AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1B, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-50a: Provide Connectivity between Coldani Marsh/White Slough Population and the Giant Garter Snake's Historical Range
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-69b: BDCP-Related Construction Will Not Result in A Net Decrease in Crane Use Days on Bract Tract
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.7 Alternative 2C—Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario B)

Alternative 2C, which is described in Section 3.5.7 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-6, would affect terrestrial biological resources in the same manner as Alternative 1C. For this reason, Alternative 2C is considered here in a summary fashion; the reader is referred to Alternative 1C for a detailed description of impacts that would be associated with implementing Alternative 2C. The impacts associated with Alternatives 1C and 2C were derived by comparing the alternatives to the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

Comparative Differences in CM1 Construction Effects for Alternatives 1C and 2C

The Alternative 2C water conveyance facilities would entail construction at north Delta Intakes W1 through W5, just as with Alternative 1C. Also, Alternative 2C would involve constructing and operating a combined canal and tunnel conveyance system in the western portion of the Delta using the same construction footprint as Alternative 1C. The Alternative 2C operational scenario (Scenario B) would have terrestrial biology effects essentially the same as Alternative 1C and its operational scenario (Scenario A). Alternative 2C operations would involve placement of a permanent operable barrier at the head of Old River in the south Delta and increased Delta freshwater outflows during September, October and November of some water years. All of the conservation measures other than CM1 operations would be the same as under Alternative 1C.

The Alternative 2C water conveyance facilities construction effects on natural communities are included in Table 12-2C-1. The principal effects of concern associated with both Alternative 1C and 2C are related to the conversion of cultivated lands, grassland, valley/foothill riparian, vernal pool complex and alkali seasonal wetland complex to water conveyance facilities (CM1; Table 12-2C-1). Similar to Alternative 1C, Alternative 2C would permanently affect a large acreage of jurisdictional waters (including wetlands) regulated by Section 404 of the CWA. Refer to Table 12-1C-69 for a summary of Alternative 1C permanent and temporary jurisdictional waters and wetlands impacts. Alternative 2C would affect the same acreage of wetlands and other waters.

Construction of the canal on the west and northwest of Clifton Court Forebay would have significant impacts on vernal pool, alkali seasonal wetland and other natural seasonal wetland natural communities. The acreages impacted here would exceed the offsetting restoration and protection included in the BDCP, so additional mitigation would be required. These effects accrue to special-status species and common wildlife species that rely on cultivated lands, managed wetlands, and seasonal wetlands during some life stage. Foraging raptors and passerines and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Vernal pools provide habitat to special-status crustaceans, California tiger salamander, numerous common waterbirds, and a suite of special-status plants. Alkali seasonal wetland complex provides habitat to California tiger salamander, numerous common waterbirds, foraging raptors and its own suite of special-status, salt tolerant plants.

The near-term conservation activities described in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for conservation, enhancement and replacement of habitats affected by the early water conveyance facility construction activities. This conservation activity, which is part of the early implementation of the BDCP, would offset some, but not all, water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Note that the acres of habitat affected by CM1, as listed in Table 12-2C-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-2C-2 and Table 12-2C-3 for the late long-term timeframe are acres affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community protection and restoration conservation measures over the course of the BDCP.

1 **Table 12-2C-1. Alternative 2C Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)[a]**

Natural Community	Total Existing Habitat in Study Area	Conveyance Option: Alternative 2C Removed Habitat (Permanent)[b]	Conveyance Option: Difference from Alternative 1C	Conveyance Option: Alternative 2C Removed Habitat (Temporary)[c]	Conveyance Option: Difference from Alternative 1C
Tidal perennial aquatic[a]	86,263	25	0	117	0
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	0	0	1	0
Valley/foothill riparian	17,966	40	0	86	0
Nontidal perennial aquatic	5,567	22	0	21	0
Nontidal freshwater perennial emergent wetland	1,509	0	0	5	0
Alkali seasonal wetland complex	3,723	13	0	9	0
Vernal pool complex	12,133	29	0	37	0
Managed wetland	70,798	1	0	145	0
Other natural seasonal wetland	842	2	0	2	0
Grassland	78,047	359	+1	320	0
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	6,073	0	9,481	0

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Canal, Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area and Borrow/Spoil Areas.

2

Effects of Restoration-Related Conservation Actions of Alternative 2C

The reader is referred to the Alternative 1C impact analysis above for the broader discussion of overall terrestrial biological resources effects that would result from implementation of restoration-related conservation measures under Alternative 2C. The principal effects of concern associated with both Alternatives 1C and 2C are related to the conversion of large acreages of cultivated lands, managed wetland, grassland and valley/foothill riparian habitat to tidal marsh and other habitat types(CM2, CM4, and CM5; Table 12-2C-2 and CM7, CM8, CM10, and CM18; Table 12-2C-3). These effects accrue to special-status species and common wildlife species, especially those that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activity (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Some of the permanent habitat loss associated with the restoration components of these alternatives would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, alkali seasonal wetland complex, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal freshwater emergent wetland, tidal brackish emergent wetland) and other natural communities. The BDCP conservation components, including restoration components (CM2–CM10), are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

NEPA Effects: Alternative 2C would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study. The construction of the canal and associated infrastructure would substantially inhibit the movement of wildlife from moving within and outside of the Delta resulting in an adverse effect. This alternative would not significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1C, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of the water conveyance canal from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize adverse effects to the maximum extent practicable. Alternative 2C would not require mitigation measures beyond what is proposed for Alternative 1C to offset effects.

CEQA Conclusion: Alternative 2C would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study.

1 **Table 12-2C-2. Alternative 2C Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)**

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,246	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-2C-3. Alternative 2C Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
Natural Community	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

The construction of the canal and associated infrastructure would substantially inhibit the movement of wildlife from moving within and outside of the Delta resulting in an adverse effect. The alternative would not increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1C, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize significant impacts. Alternative 2C would not require mitigation measures beyond what is proposed for Alternative 1C to offset effects. Despite these measures, there would remain a significant and unavoidable impact on wildlife movement corridors from Alternative 6C.

As with Alternative 1C, Alternative 2C would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 2C AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1C, are as follows:

- Mitigation Measure BIO-18: Compensate for Loss of Alkali Seasonal Wetland Complex
- Mitigation Measure BIO-27: Compensate for Loss of Other Natural Seasonal Wetland
- Mitigation Measure BIO-32: Restore and Protect Vernal Pool Crustacean Habitat

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-91a, Compensate for Permanent Loss of Low-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.8 Alternative 3—Dual Conveyance with Pipeline/Tunnel and Intakes 1 and 2 (6,000 cfs; Operational Scenario A)

Alternative 3, which is described in Section 3.5.8 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-2, would affect terrestrial biological resources in a similar fashion to Alternative 1A. For this reason, Alternative 3 is considered here in a summary fashion; the reader is referred to Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 3. The impacts associated with Alternatives 1A and 3 were derived by comparing the alternatives to the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

Comparative Differences in CM1 Construction Effects for Alternatives 3 and 1A

The principal differences between these two alternatives are related to the differing construction footprints of the water conveyance facilities (CM1). The Alternative 3 water conveyance facilities would entail construction at north Delta Intakes 1 and 2 rather than Intakes 1–5. The locations of these intakes are depicted in Figure 3-2. Eliminating Intakes 3–5 would reduce the construction footprint along the eastern bank of the Sacramento River just upstream and downstream of the community of Hood. The operational scenario for Alternative 3 (Operational Scenario A) is the same as for Alternative 1A, although less water would be diverted from the north Delta during certain periods when compared with Alternative 1A. Also, all of the conservation measures other than CM1 would be the same as under Alternative 1A. Therefore, operations and conservation effects on terrestrial biological resources would be identical under these two alternatives.

Due to the elimination of Intakes 3–5 and their associated pumps and pipelines, Alternative 3 would create differences in the permanent and temporary loss of natural communities and cultivated lands during water conveyance facilities construction when compared with Alternative 1A (Table 12-3-1). All of these differences would occur during the near-term timeframe associated with water conveyance facilities construction. Alternative 3 would permanently remove 9 fewer acres of tidal perennial aquatic habitat in the Sacramento River, 10 fewer acres of valley/foothill riparian habitat along the eastern bank of the Sacramento River, 11 fewer acres of grassland adjacent to the river, and 118 acres of cultivated land just east of the river, all associated with less intake construction along the eastern bank of the Sacramento River in the vicinity of Hood. Alternative 3 would also permanently affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared with Alternative 1A (10 acres fewer; see Table 12-3-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

There would be similar reductions in temporary losses of natural communities along the Sacramento River, including 32 fewer acres of tidal perennial aquatic, 3 acres fewer of tidal freshwater emergent wetland, 10 acres fewer of valley/foothill riparian, one acre fewer of nontidal perennial aquatic, 28 acres fewer grassland, and 348 acres fewer of cultivated land (Table 12-3-1). Alternative 3 would also temporarily affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (39 acres fewer; see Table 12-3-2).

Note that the acres of habitat affected by CM1, as listed in Table 12-3-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-3-3 and Table 12-3-4 for other conservation actions are for the late long-term timeframe; the numbers represent acres affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community protection and restoration conservation measures over the course of the BDCP.

Table 12-3-1. Alternative 3 Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

		Conveyance Option			
Natural Community	Total Existing Habitat in Study Area	Alternative 3 Removed Habitat (Permanent)[b]	Difference from Alternative 1A	Alternative 3 Removed Habitat (Temporary)[c]	Difference from Alternative 1A
Tidal perennial aquatic[a]	86,263	39	-9	101	-32
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	3	-3
Valley/foothill riparian	17,966	49	-9	18	-10
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	304	-11	234	-28
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	3,706	-130	1,843	-348

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Canal, Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, Reusable Tunnel Material Storage Areas and Borrow/Spoil Areas.

[c] Features in this category include the following conveyance features: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area.

Table 12-3-2 Alternative 3 Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1A (acres)

	Alternative 3 Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1A	Temporary Impact	Difference from Alternative 1A
Agricultural Ditch	64.8	-0.2	21.0	-2.5
Alkaline Wetland	0.1	0	0	0
Clifton Court Forebay	1.0	0	0	0
Conveyance Channel	12.7	0	1.1	0
Depression	1.9	0	1.8	0
Emergent Wetland	46.8	0	4.7	-2.5
Forest	5.8	0	11.3	-0.7
Lake	0	0	0	-0.3
Scrub-Shrub	18.2	-2.4	2.1	-2.2
Seasonal Wetland	18.7	0	26.6	0
Tidal Channel	35.0	-7.9	102.8	-31.0
Vernal Pool	0	0	0	0
Total	**205**	**-10**	**171**	**-39**

These differences in loss of natural communities associated with construction of CM1 would create differences in effects on covered and noncovered wildlife. The reduced level of valley/foothill riparian habitat loss would be a positive influence on valley elderberry longhorn beetle, breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, white-tailed kite, Cooper's hawk, and black-crowned night heron), and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. Species that would benefit from smaller permanent losses of grassland and cultivated land would include foraging raptors (Swainson's hawk, short-eared owl, northern harrier, merlin and white-tailed kite), greater sandhill crane, California horned lark, tricolored blackbird, mountain plover and several species of bats. Alternative 3 would result in a slightly smaller permanent loss (94 acres less) of crane foraging habitat compared to Alternative 1A. The significantly smaller temporary habitat conversions associated with Alternative 3 would have comparable benefits to these species. There would be 262 fewer acres of foraging habitat temporarily lost under Alternative 3 for greater sandhill crane when compared to Alternative 1A because of the lower acreage of cultivated land loss. However, the effects would be offset in the near-term by AMMs adopted for specific species, including greater sandhill crane, and over time by on-site restoration required by *AMM10 Restoration of Temporarily Affected Natural Communities*.

The differences in effect that the water conveyance facilities of Alternatives 1A and 3 could have on special-status plant species are minor. Habitat modeling indicates that Alternative 3 would create 1 fewer acre of permanent habitat loss for side-flowering skullcap, 3 fewer acres of permanent habitat loss for Mason's lilaeopsis and delta mudwort, and 5 acres less temporary loss of habitat for Mason's lilaeopsis and delta mudwort when compared with Alternative 1A.

The near-term conservation activities described and evaluated in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for protection, enhancement and restoration of habitats affected by the near-term water conveyance facilities construction activities. This conservation activity, which is part of the early implementation of the BDCP, would offset water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Effects of Restoration-Related Conservation Actions of Alternative 3

Natural community changes associated with the major restoration-related conservation measures under Alternative 3 (CM2, CM4, and CM5; see Table 12-3-3 and CM7, CM8, CM10, and CM18; Table 12-3-4) would be identical to those described for Alternative 1A.

Table 12-3-3. Alternative 3 Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-3-4. Alternative 3 Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Land (acres)

	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
Natural Community	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

The reader is referred to the Alternative 1A impact analysis above for the broader discussion of overall terrestrial biological resources effects that would result from implementation of restoration-related conservation measures under Alternative 3. The principal effects of concern associated with both Alternative 1A and 3 are related to the conversion of large acreages of cultivated lands, managed wetland, grassland and valley/foothill riparian habitat to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) and other habitat types during restoration activities. These effects accrue to special-status species and common wildlife species, especially those that rely on cultivated lands and managed wetland during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activity (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Some of the permanent habitat loss associated with the restoration components of Alternative 3 would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh and other natural communities. The BDCP conservation components, including the restoration components (CM2-CM10) are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan, including those that rely on managed wetland and cultivated land. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

***NEPA Effects*:** Alternative 3 would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 3 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

CEQA Conclusion: Alternative 3 would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 3 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

As with Alternative 1A, Alternative 3 would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 3 AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.9 Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)

Chapter 3, Section 3.5.9, *Alternative 4*, provides details of Alternative 4, and Figures 3-9 and 3-10 depict the alternative.

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance, and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal or modification of this community (see Table 12-4-1). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the tidal perennial aquatic natural community (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3 of the BDCP that would improve the value of tidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to AMMs, impacts on tidal aquatic natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Note that two time periods are represented in Table 12-4-1 and the other tables contained in the analysis of Alternative 4. The near-term (NT) acreage effects listed in the table would occur over the near-term of Alternative 4 implementation. The late long-term (LLT) effects contained in these tables represent the combined effects of all activities over the entire 50-year term of the Plan. This table and all impact tables in the chapter include reference to only those conservation measures that would eliminate natural community acreage either through construction or restoration activities, or would result in periodic inundation of the community.

Table 12-4-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	280	280	2,019[e]	2,019	0	0
CM2	8	8	11	11	9–36	0
CM4	14	18	0	0	0	0
CM5	0	2	0	5	0	39
CM6	Unk.	Unk.	0	0	0	0
TOTAL IMPACTS	**302**	**308**	**2,030**	**2,035**	**9–36**	**39**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
[e] The large acreage of tidal perennial aquatic habitat affected by Alternative 4 is related to dredging of Clifton Court Forebay; the habitat would not be permanently removed.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 for Alternative 4 would permanently affect an estimated 308 acres and temporarily disturb 2,035 acres of tidal perennial aquatic natural community in the study area. The large temporary loss of this natural community would be largely related to dredging of Clifton Court Forebay (1,931 acres). These modifications represent less than 3% of the 86,263 acres of the community that is mapped in the study area. The majority of the permanent and temporary effects would happen during the near-term time period for Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 8,300 acres of tidal wetlands, including an estimated 3,400 acres of tidal perennial aquatic natural community during the same period, which would expand the area of that habitat and offset the losses. The 3,400-acre increase is estimated, based on modeling reported in BDCP Appendix 3.B, Table 5, by comparing existing Plan Area subtidal habitat to near-term subtidal habitat with the Plan. The effects analysis in Chapter 5, Section 5.4.1.2, *Beneficial Effects Analysis*, of the BDCP indicates that, while there would be no minimum restoration requirement for the tidal perennial aquatic natural community, an estimated approximately 27,000 acres of tidal perennial aquatic natural community would be restored based on tidal restoration modeling. This estimate is based on Table 5 in Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, of the BDCP, by subtracting late long-term acreage without project from late long-term acreage with project.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 4 water conveyance facilities would permanently remove 280 acres and temporarily disturb 2,019 acres of tidal perennial aquatic community. Most of the permanent loss would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland (see Terrestrial Biology Mapbook for a view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay, and where permanent new transmission lines would be constructed along Lambert Road just west of Interstate 5.

  The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest affect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at three locations along the tunnel route. The barge unloading construction would temporarily affect Snodgrass Slough just south of Hood, Potato Slough at the south end of Boldin Island, Venice Reach of the San Joaquin River at the south end of Venice Island, Old River on the east side of Clifton Court Forebay, Connection Slough at the north end of Bacon Island, and Old River just south of its junction with North Victoria Canal. The details of these locations can be seen in the Terrestrial Biology Mapbook. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 8 acres could be permanently lost and another 11 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would affect 18 acres of tidal perennial aquatic community. CM4 involves conversion of existing natural communities to a variety of tidal wetlands, including tidal perennial aquatic, tidal brackish emergent, and tidal freshwater emergent wetlands. Specific locations for these conversions are not known. The 18 acres could remain tidal perennial aquatic with a modified tidal prism, or they could eventually be converted to one of the other tidal wetland types. For purposes of this analysis, a conservative approach has been taken and the effect has been discussed simultaneously with the habitat losses associated with other conservation measures.

  An estimated 65,000 acres of tidal wetlands and transitional uplands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic habitat would be restored, based on modeling conducted by ESA PWA (refer to Table 5 in Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, of the BDCP). This restoration would be consistent with BDCP Objective TPANC1.1. Approximately 3,400 acres of the restoration would happen during the near-term time period of Alternative 4 implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following years of Plan implementation. Tidal natural communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 2 acres and temporarily remove 5 acres of tidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the tidal perennial aquatic habitats directly affected. This activity is scheduled to start following construction of water conveyance facilities. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on tidal perennial aquatic habitat. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 14 years of BDCP implementation), Alternative 4 would affect the tidal perennial aquatic community through CM1 construction losses (280 acres permanent and 2,019 acres temporary) and the CM2 construction losses (8 acres permanent and 11 acres temporary). These losses would occur primarily at Clifton Court Forebay due to dredging, along the Sacramento River at intake sites, or in the northern Yolo Bypass. Approximately 14 acres of the inundation and construction-related effects resulting from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The largest loss would occur at Clifton Court Forebay, and would be temporary. This tidal perennial habitat is of relatively low value to special-status terrestrial species in the study area. The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 14 years of Alternative 4 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 2,332 acres of restoration would be needed to offset (i.e., mitigate) the 2,332 acres of effect (the total permanent and temporary near-term effects listed in Table 12-4-1) associated with near-term activities, including water conveyance facilities construction.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in relatively minor (less than 3%) conversions of or losses to tidal perennial aquatic community in the study area. These losses or conversions (308 acres of permanent and 2,035 acres of temporary) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation conversions would occur through the course of the BDCP restoration program at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of more than 27,000 acres of high-value tidal perennial aquatic natural community would be restored (estimated from Table 5 in Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, of the BDCP). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 4 implementation would offset near-term losses associated with construction activities for CM1, CM2, CM4 and CM6, avoiding any adverse effect. Alternative 4, which includes restoration of an estimated 27,000 acres of this natural community over the course of the Plan, would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 4 would result in the near-term loss, conversion, and temporary disturbance of approximately 2,332 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily at Clifton Court Forebay, along the Sacramento River at intake sites, along various Delta waterways at barge offloading sites, and within the northern section of the Yolo Bypass, while inundation conversions would occur at various tidal restoration sites throughout the study area. The losses and conversions would be spread across the near-term timeframe. These losses and conversions would be offset by planned restoration of an estimated 3,400 acres of high-value tidal perennial aquatic natural community scheduled for the first 10 years of Alternative 4 implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 2,332 acres of restoration would be needed to offset (i.e., mitigate) the 2,332 acres of loss or conversion. The restoration would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 2,343 acres of the natural community would be lost or converted and an estimated 27,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 4 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Two Alternative 4 conservation measures would modify the water depths and inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation and changes in water depth and velocity of 9–36 acres of tidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 9-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 36-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of the tidal perennial aquatic community occurs in the southern section of the bypass on Liberty Island, and, to a lesser extent, along the eastern edge of the bypass, including the Tule Canal/Toe Drain. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would be expected to be beneficial to the ecological function of tidal perennial aquatic habitat in the bypass as it relates to BDCP covered aquatic species. The Yolo Bypass waterway is the key element in the Yolo Bypass landscape linkage mapped in Figure 12-2 and described in detail in BDCP Chapter 3, Table 3.2-3. The change in periodic inundation in the bypass would not substantially modify its value for special-status or common terrestrial species. Water depths and water flow rates would increase over Existing Conditions and the No Action condition in approximately 30% of the years, but it would not fragment the habitat or make it less accessible to special-status or common terrestrial species. The modifications would not result in a loss of this community. The plant species associated with this community are adapted to inundation. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of these changes in the inundation regime on terrestrial species that rely on tidal perennial aquatic habitats are discussed in detail later in this chapter, under the individual species assessments.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of flooding of 39 acres of tidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The more frequent exposure of these wetlands to stream flooding events would be beneficial to the ecological function of tidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The plant species associated with these tidal perennial aquatic areas are adapted to inundation and would not be substantially modified.

In summary, 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity as a result of implementing two Alternative 4 conservation measures (CM2 and CM5). Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area; therefore, periodic changes in water depth and velocity would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of tidal perennial aquatic natural community would not have an adverse effect on the community.

CEQA Conclusion: An estimated 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from flood flows as a result of implementing CM2 and CM5 under Alternative 4. Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include diverting Sacramento River flows in the north Delta, and reduced diversion from south Delta channels. These actions are associated with CM1 (see Impact BIO-2 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 4 operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control* and is consistent with BDCP Objective TPANC2.1. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging.* Long-term operation of the Alternative 4 intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed later in this chapter.
- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the tidal perennial aquatic natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and

CM11 Natural Communities Enhancement and Management, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage or value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal perennial aquatic natural community.

Tidal Brackish Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no adverse effect on the habitats associated with the tidal brackish emergent wetland natural community. Habitat restoration and construction associated with CM1, CM2, CM5 and CM6 would not remove tidal brackish emergent wetland; levee breaching and minor construction associated with CM4 may temporarily remove small amounts of this natural community (see Table 12-4-2). Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit the tidal brackish emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create at least 6,000 acres of tidal brackish emergent wetland in Conservation Zone 11 (Objective TBEWNC1.1 associated with CM4).
- Restore connectivity to isolated patches of tidal brackish emergent marsh where isolation has reduced effective use of these marshes by the species that depend on them (Objective TBEWNC1.3 associated with CM4).
- Create topographic heterogeneity in restored tidal brackish emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TBEWNC1.4 associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1 associated with CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal brackish emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-2. Changes in Tidal Brackish Emergent Wetland Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	Unk.	Unk.	Unk.	Unk.	0	0
CM5	0	0	0	0	0	0
CM6	0	0	0	0	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction of the Alternative 4 water conveyance facilities (CM1) would not affect tidal brackish emergent wetland natural community.

Restoration of tidal marsh habitats associated with CM4 would require site preparation, earthwork, and other site activities that could remove tidal brackish emergent wetland. Levee modifications, grading or contouring, filling to compensate for land subsidence, and creation of new channels could also result in the removal of tidal brackish emergent wetland. All of this construction and land modification activity that could affect tidal brackish emergent wetland would take place in Suisun Marsh (CZ 11). The acreage of loss has not been calculated because the specific locations for site preparation and earthwork have not been identified, but the loss would likely be very small (less than 1 acre). These activities would occur in small increments during the course of the CM4 restoration program. The restoration elements of CM4 would greatly exceed any of the short-term losses described above. At least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area (BDCP Objective TBEWNC1.1, associated with CM4), with 2,000 acres of restoration occurring in the near-term timeframe. In addition, the habitat and ecosystem functions of BDCP restored tidal brackish emergent wetland would be maintained and enhanced (CM11). The BDCP beneficial effects evaluation of Alternative 4 (see Chapter 5, Section 5.4.3.2, *Beneficial Effects, of the BDCP*) states that at least 6,000 acres of tidal brackish emergent wetland community would be restored in CZ 11, and that tidal natural communities restoration would decrease habitat fragmentation by providing additional connectivity between isolated patches of tidal brackish emergent wetland.

The restoration activities associated with CM4 in Suisun Marsh would result in other effects that could alter the habitat value of tidal brackish emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Tidal flooding of dry areas could also increase the bioavailability of methylmercury in Suisun Marsh. Site-specific conditions would dictate the significance of this hazard to tidal brackish marsh vegetation and associated wildlife. According to the Suisun Marsh Plan EIR/EIS (Bureau of Reclamation et al. 2010, pg. 5.2-18), marsh creation may generate less methylmercury than is currently being generated by managed wetlands. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh and the potential for increased nitrogen deposition associated with construction vehicles are also issues of concern that are difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal brackish emergent wetland in the study area.

NEPA Effects: The increase of tidal brackish emergent wetland associated with CM4 would be a beneficial effect on the natural community.

CEQA Conclusion: Tidal brackish emergent wetland natural community could experience small losses in acreage in Suisun Marsh (CZ 11) as a result of the large-scale tidal marsh restoration planned as part of CM4. These losses (expected to not exceed 1 acre) would be associated with levee modification, site preparation, and other earthwork needed to expose diked lands to tidal influence. Because at least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area as part of CM4, including 2,000 acres restored in the near-term timeframe, there would be a large increase in tidal brackish emergent wetland both in the near-term and over the life of the Plan. Indirect effects associated with the expansion of tidal brackish emergent wetland natural community, including the potential spread of invasive species, the generation of methylmercury, increases in marsh water temperatures, and increased nitrogen deposition are not expected to have a significant impact on this natural community in the study area. Therefore, this impact would be beneficial.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with CM1 and CM4 of Alternative 4 are constructed and the water management practices associated with changed reservoir operations, diversions from the north Delta, and marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions include water releases and diversions, access road and levee repair, and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh channels would be expected to increase with reduced Sacramento River outflows (see Chapter 8, *Water Quality*, Section 8.3.3.9), but this change would not be sufficient to change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area due to BDCP Shift in Export Location and Volume*, of the BDCP for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road and levee repair.* Periodic repair of access roads and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and*

Sediment Control Plan. Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment (CM11), would be a periodic activity associated with the long-term maintenance of restoration sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

- *Channel dredging.* Long-term maintenance of tidal channels that support wetland expansion in Suisun Marsh would include periodic dredging of sediments. The dredging would occur adjacent to tidal brackish emergent wetland natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value in the short term for special-status and common species that rely on it for cover, movement corridor or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, channel dredging and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in the tidal brackish emergent wetland natural community within the study area. There would be no adverse effect on the tidal brackish emergent wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes (not exceeding 1 acre) in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of small acreages of this community (see Table 12-4-3). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the tidal freshwater emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the 65,000 acres of tidal natural communities, restore or create at least 24,000 acres of tidal freshwater emergent wetland in Conservation Zones 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Restore tidal freshwater emergent wetlands in areas that increase connectivity among conservation lands (Objective TFEWNC1.2, associated with CM4).
- Restore and sustain a diversity of marsh vegetation that reflects historical species compositions and high structural complexity (Objective TFEWNC2.1, associated with CM4).

- Create topographic heterogeneity in restored tidal freshwater emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TFEWNC2.2, associated with CM4).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, that would improve the value of tidal freshwater emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-3. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	1	1	10	10	0	0
CM2	6	6	0	0	24–58	0
CM4	1	1	0	0	0	0
CM5	0	1	0	1	0	3
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**8**	**9**	**10**	**11**	**24–58**	**3**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 for Alternative 4 would permanently eliminate an estimated 9 acres and temporarily remove 11 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 14 years of Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add at least 24,000 acres of tidal freshwater emergent wetland natural community during the course of Plan restoration activities, which would greatly expand the area of that habitat and offset the losses. The BDCP beneficial effects evaluation of Alternative 4 (see Chapter 5, Section 5.4.4.2, *Beneficial Effects*, of the BDCP) states that the implementation of *CM4 Tidal Natural Communities Restoration* would restore at least 24,000 acres of tidal freshwater emergent wetland community in Cache Slough (Conservation Zones 1, 2, and 3), the Cosumnes/Mokelumne (Conservation Zone 4), West Delta (Conservation Zone 5 and 6), and South Delta (Conservation Zone 7) ROAs. The BDCP evaluation also states that the objectives in the Plan would promote vegetation diversity and structural complexity (as incorporated into the restoration design) in restored tidal freshwater marsh.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 4 water conveyance facilities would permanently remove 1 acres and temporarily remove 10 acres of tidal freshwater emergent wetland community. Most of the loss would occur along rivers and canals in the central Delta from barge unloading facility construction (Old River on the northwest corner of Victoria Island and Connection Slough at the north end of Mandeville Island), and from transmission line construction (San Joaquin River and Potato Slough at the south and north ends of Venice Island, Connection Slough at the north end of Bacon Island, and Railroad Slough at the north end of Woodward Island; see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.

  There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of CM1. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities,* of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction or channel modification activities within the Yolo and Sacramento Bypasses, including improvements in flow through the west side channel of the bypass, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in tidal freshwater emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 6 acres could be permanently lost to these activities. The loss is expected to occur in the near-term time period of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on hypothetical footprints of this restoration activity, initial land grading and levee modification could permanently remove 1 acre of tidal freshwater emergent wetland natural community. This loss would occur in the near-term timeframe and would occur throughout the ROAs identified for tidal wetland restoration. At the same time, an estimated 24,000 acres of tidal freshwater emergent wetland community would be restored during tidal habitat restoration, consistent with Objective TFEWNC1.1, (associated with CM4). Approximately 8,850 acres of the restoration would happen during the first 10 years of Alternative 4 implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal wetland communities restoration is expected to be focused in the ROAs identified in Figure

12-1. Restoration would be located and designed to improve habitat connectivity (Objective TFEWNC1.2), improve marsh species diversity (Objective TFEWNC2.1), and provide variation in inundation characteristics (Objective TFEWNC2.2). Some of the restoration would be implemented in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

The restoration activities associated with CM4 in the Plan Area ROAs would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal freshwater marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough, Cosumnes/Mokelumne and Suisun Marsh ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration levee construction would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater emergent wetland habitat. The construction-related losses would be considered a permanent removal of the habitats directly affected. The majority of seasonally inundated floodplain restoration is expected to occur along the lower San Joaquin River in the south and central Delta areas. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on freshwater marsh and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on narrow strips of habitat, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the tidal freshwater emergent wetland natural community through CM1 construction losses (1 acres permanent and 10 acres temporary), CM2 construction losses (6 acres permanent), and CM4 construction losses (1 acre permanent). These losses would occur in the central Delta from construction of barge unloading facilities and transmission lines on the fringes of Venice, Bacon and Woodward Islands, and in various locations within the Yolo Bypass and the tidal restoration ROAs.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 4 implementation would more than offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 18 acres of restoration would be needed to offset (i.e., mitigate) the 18 acres of loss (the total permanent and temporary near-term effects listed in Table 12-4-3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in relatively minor (less than 1%) losses of tidal freshwater emergent wetland community in the study area. These losses (9 acres of permanent and 11 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and levee modification and land grading associated with tidal marsh restoration (CM4) and floodplain restoration (CM5). The CM4 and CM5 losses would occur during the course of conservation actions at various tidal and floodplain restoration sites throughout the study area. By the end of the Plan timeframe, a total of 24,000 acres of this natural community would be restored. The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during near-term of Alternative 4 implementation would more than offset the construction and inundation-related effects of implementing CM1, CM2, CM4, and CM5, avoiding any adverse effect in the near-term. Because of the 24,000 acres of tidal freshwater emergent wetland restoration that would occur over the course of the Plan, Alternative 4 would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 4 would result in the loss of approximately 18 acres of tidal freshwater emergent wetland natural community (permanent and temporary) due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and tidal marsh restoration (CM4). The construction losses would occur in primarily in the central Delta on the fringes of Venice, Bacon and Victoria Islands, and in the Yolo Bypass and various tidal restoration ROAs. The losses would be spread across the near-term timeframe and would be offset by planned restoration of 8,850 acres of tidal freshwater emergent wetland natural community scheduled for the first 10 years of Alternative 4 implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant and no mitigation would be required. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 18 acres of restoration would be needed to offset (i.e., mitigate) the 18 acres of loss. The restoration would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species.

Late Long-Term Timeframe

At the end of the Plan period, 20 acres of this community would be lost to construction and restoration activities and 24,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 4 would not have a substantial adverse effect on this natural community; the impact on the tidal freshwater emergent wetland natural community would be beneficial.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal freshwater emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation of 24–58 acres of tidal freshwater emergent wetland natural community. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. The area more frequently inundated would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 24-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 58-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of this community occurs in the southern section of the bypass on Liberty Island, on the fringes of tidal perennial aquatic habitats. Smaller areas are scattered among the cropland within the bypass, south of Interstate 80. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of tidal freshwater emergent wetland habitats and would not substantially modify its value for special-status or common terrestrial species. The plants in this natural community are adapted to periodic inundation events within the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of inundation of 3 acres of tidal freshwater emergent wetland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to their ecological function, especially as they relate to BDCP target terrestrial and aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 27-618 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5). Tidal freshwater emergent wetland natural community is a habitat of great value to both terrestrial and aquatic species in the study area, and increases in inundation for relatively short periods of time would not reduce the acreage or the value of this community.

NEPA Effects: Periodic inundation would not result in a net permanent reduction in the acreage or value of tidal freshwater emergent wetland in the study area. Therefore, there would be no adverse effect.

CEQA Conclusion: An estimated 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. This community is of great value to aquatic and terrestrial species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage or value of this community in the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions would include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-7 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4 (Operational Scenario H) would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and

Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a significant reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.

The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area due to BDCP Shift in Export Location and Volume*, in the BDCP, for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The BDCP proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the Plan Area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the Plan Area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (CM11). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4 intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed later in this chapter.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance, and management activities would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4, including changed water operations in the upstream rivers, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-4-4). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the valley/foothill riparian natural community.

- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5 and CM7).
- Maintain 500 acres of mature riparian forest in Conservation Zones 4 or 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to late-successional riparian vegetation (VFRNC2.2,) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).
- Maintain or increase abundance and distribution of valley/foothill riparian natural community vegetation alliances that are rare or uncommon as recognized by California Department of Fish and Game (2010), such as button willow thickets alliance and blue elderberry stands alliance (Objective VFRNC3.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of valley/foothill riparian natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-4. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	37	37	24	24	0	0
CM2	89	89	88	88	51–92	0
CM4	298	552	0	0	0	0
CM5	0	43	0	35	0	266
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**424**	**721**	**112**	**147**	**51–92**	**266**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 721 acres and temporarily remove 147 acres of valley/foothill riparian natural community in the study area. These modifications represent approximately 5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the near-term time period of Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Valley/foothill riparian protection (750 acres) and restoration (800 acres) would be initiated during the same period, which would begin to offset the losses. By the end of the Plan period, 5,000 acres of this natural community would be restored. The analysis in Chapter 5, Section 5.4.5.2, *Beneficial Effects*, of the BDCP indicates that implementation of Alternative 4 would restore or create 5,000 acres of riparian forest and scrub in Conservation Zones 1, 2, 4, 5, 6, and 7, with at least 3,000 acres occurring on restored seasonally inundated floodplain. Alternative 4 would also protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 4 water conveyance facilities would permanently remove 37 acres and temporarily remove 24 acres of valley/foothill riparian natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees (*acacia*) and scrub vegetation (see Terrestrial Biology Mapbook). Cottonwood, willow and mixed brambles would be permanently lost at the ponds created by excavation for the peripheral canal both north and south of Twin Cities Road just west of Interstate 5, as these sites would be used to deposit reusable tunnel material. Some cottonwood and valley oak riparian would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Blackberry brambles would also be lost to deposit of reusable tunnel material at the east end of Bouldin Island. Smaller areas dominated by blackberry would be eliminated at the forebay site adjacent to Clifton Court Forebay and patches of willow and blackberry would be lost along the transmission line corridors where they cross waterways in the central and south Delta. Permanent losses would occur along Lambert Road where permanent utility lines would be installed. Temporary losses would also occur adjacent to temporary intake work areas. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak, cottonwood, willow and scrub vegetation. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 89 acres could be permanently lost and another 88 acres could be temporarily removed. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. This vegetation is a mix of valley oak, cottonwood, sycamore and willow trees. The riparian areas here are primarily small, disconnected patches with moderate to low value as wildlife movement corridors. Most of these patches lack structural complexity. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would remove similar linear strips of vegetation. These losses would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 552 acres of valley/foothill riparian community. The losses would be spread among most of the ROAs established for tidal restoration (see Figure 12-1). No losses would occur from Suisun Marsh restoration. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (see Chapter 5, Section 5.4.5.1.1, *Permanent Loss and Fragmentation*, of the BDCP). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted by use of

the theoretical footprint. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.

- *CM5 Seasonally Inundated Floodplain Restoration:* Floodplain restoration levee construction would permanently remove 43 acres and temporarily remove 35 acres of valley/foothill riparian natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). This activity is scheduled to start following construction of water conveyance facilities.
- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration:* The valley/foothill riparian natural community would be restored primarily in association with the tidal (CM4) and floodplain (CM5) restoration and channel margin enhancements. Following community-specific goals and objectives in the Plan, a total of 5,000 acres of this community would be restored (Objective VFRNC1.1) and 750 acres would be protected (Objective VFRNC1.2) over the life of the Plan. Approximately 800 acres would be restored and the entire 750 acres would be protected in the first 10 years of Plan implementation. Riparian restoration and protection would be focused in CZ 4 and CZ 7 (Objective VFRNC2.3), with a goal of adding a 500-acre portion of the restoration in one or the other of these zones. A variety of successional stages would also be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area (Objective VFRNC2.4).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the valley/foothill riparian natural community through CM1 construction losses (37 acres permanent and 24 acres temporary) and the CM2 construction losses (89 acres permanent and 88 acres temporary). These losses would occur along the eastern bank of the Sacramento River at intake sites; along transmission lines in the central and south Delta and along Lambert Road; at reusable tunnel material storage sites near Twin Cities Road, Clifton Court Forebay, and on Bouldin Island; and in the northern Yolo Bypass. Approximately 298 acres of the inundation and construction-related loss from CM4 would occur in the near-term. These losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with BDCP conservation components. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined in Section 404 of the CWA. As indicated above, most of the losses would be in small patches or narrow strips along waterways, with limited structural complexity. However, the restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 4 implementation would minimize this near-term loss, avoiding any adverse effect. At least 400 acres of the protection is planned for the first 5 years of Alternative 4 implementation. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 536 acres of protection and 536 acres of restoration would be needed to offset (i.e., mitigate) the 536acres of loss (the combination of permanent and temporary losses in the near-term listed in Table 12-4-4). The combination of the two approaches (protection and restoration) are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk and White-Tailed Kite.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in approximately 5% losses of valley/foothill riparian natural community in the study area. These losses (721 acres of permanent and 147 acres of temporary) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and setback of levees during floodplain expansion (CM5). Inundation losses would occur through the course of the BDCP restoration program at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 5,000 acres of this natural community would be restored and 750 acres would be protected (CM7 and CM3, respectively), primarily in CZ 4 and CZ 7 in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

NEPA Effects**:** The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 4 implementation would minimize the near-term loss of this community, avoiding any adverse effect. Because of the Plan's commitment to restoration of 5,000 acres and protection of 750 acres of valley/foothill riparian natural community during the course of the Plan, Alternative 4 would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 4 would result in the loss of approximately 536 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily along the Sacramento River at intake sites; along transmission corridors in the central and south Delta and along Lambert Road; at reusable tunnel material storage sites on Bouldin Island, Clifton Court Forebay and near Twin Cities Road; and within the northern section of the Yolo Bypass, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across the near-term timeframe. These losses would be minimized by planned restoration of 800 acres (CM7) and protection (including significant enhancement) of 750 acres (CM3) of valley/foothill riparian natural community scheduled for the first 10 years of Alternative 4 implementation. At least 400 acres of the protection is planned for the first 5 years of Alternative 4 implementation. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts. Because of these near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 536acres of protection and 536 acres of restoration would be needed to offset (i.e., mitigate) the 536 acres of loss. The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 868 acres of valley/foothill riparian natural community would be permanently or temporarily removed by conservation actions, 5,000 acres would be restored and 750 acres would be protected. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 4 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of valley/foothill riparian natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation of 51–92 acres of valley/foothill riparian natural community. The area more frequently inundated would vary with the flows that would be passed through the newly constructed notch in the Fremont Weir. The 51 acres would be created by a notch flow of 8,000 cfs and the 92 acres would be created by a notch flow of 4,000 cfs. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. These increased flow conditions would be expected to occur in no more than 30% of all years. The valley/foothill riparian community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass. There are other riparian habitat areas on Liberty Island, and, to a lesser extent, along the eastern and western edges of the bypass, including along the Tule Canal/Toe Drain, the west side channels and the Sacramento Bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect riparian habitats, as they have persisted under similar high flows and extended inundation periods in the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 266 acres of valley/foothill riparian habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The reconnection of riparian vegetation to periodic stream flooding events would be beneficial to the ecological function of this natural community, especially in the germination and establishment of native riparian plants as flood scour increases.

In summary, 317–368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5). The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. The increased inundation could create a beneficial effect on the community as it relates to germination and establishment of native riparian plants.

NEPA Effects: Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial effect on the community.

CEQA Conclusion: An estimated 317–368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial impact on the community.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see Impact BIO-10 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with

Alternative 4, as compared to no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with Operational Scenario H) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced by as much as 19% in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 48% with implementation of Alternative 4. Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 11–27% compared with No Action, depending on month and water-year type (see Appendix 11C, Section 11C.4, *Alternative 4*). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

  The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4 would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4 intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (Chapter 3, Section 3.4.11 of the BDCP and Appendix 11F, Section 11F.3.2.5 of the EIR/EIS) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat. The BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM18, and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with implementation of Alternative 4 would not result in a net permanent reduction in the valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, and AMM18 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration and protection activities associated with *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-4-5). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the nontidal perennial aquatic natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP that would improve the value of nontidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-5. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	58	58	6	6	0	0
CM2	24	24	12	12	50–77	0
CM4	34	189	0	0	0	0
CM5	0	28	0	16	0	25
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**116**	**299**	**18**	**34**	**50–77**	**25**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 299 acres and temporarily remove 34 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 6% of the 5,567 acres of the community that is mapped in the study area. Approximately 45% (134 acres) of the permanent and temporary losses would occur during the near-term of Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 400 acres (CM10) of nontidal marsh during the same period which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1. The analysis in Chapter 5, Section 5.4.6.2, *Beneficial Effects*, of the BDCP indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh, and that the restoration would occur in blocks that are contiguous with the Plan's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998).

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 water conveyance facilities would permanently remove 58 acres and temporarily remove 6 acres of nontidal perennial aquatic community. Most of the permanent loss would occur at the linear ponds associated with the proposed peripheral canal north and south of Twin Cities Road just west of Interstate 5 and a reusable tunnel material storage site on Bouldin Island (see Terrestrial Biology Mapbook). Most of the temporary loss would occur where transmission line construction would cross Mandeville Island. These wetlands are linear ponds or small, isolated areas surrounded by agricultural land. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels modifications, Putah Creek realignment activities, and Sacramento Weir and Tule Canal improvements. All of these activities could involve excavation and grading in nontidal perennial aquatic areas to improve passage of fish through the bypass. Based on hypothetical construction footprints, a total of 24 acres could be permanently lost and another 12 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently change to tidally influenced inundation or remove 189 acres of nontidal perennial aquatic community. These losses would be expected to occur primarily in the Cache Slough and Cosumnes/Mokelumne ROAs (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored. Approximately 400 acres of the restoration (CM10) would happen during the first 10 years of Alternative 4 implementation, which would coincide with the timeframe of water conveyance facilities construction and early restoration activities. The remaining restoration would be spread over the following 30 years. Nontidal natural communities restoration is expected to be focused in the CZs 2, 4 and/or 5 in Figure 12-1.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would permanently remove 28 acres and temporarily remove 16 acres of nontidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the nontidal perennial aquatic habitats. It is expected that floodplain restoration would be focused on the south part of the Plan Area, in CZ 7. Floodplain restoration along the southern Delta rivers would improve connectivity for a variety of species that rely on aquatic and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River, Middle River and Old River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks.

Nontidal marsh adjacent to these tidal areas could be affected. The improvements would be undertaken within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the nontidal perennial aquatic community through CM1 construction losses (58 acres permanent and 6 acres temporary) and the CM2 construction losses (24 acres permanent and 12 acres temporary). These losses would occur primarily at linear ponds near Twin Cities Road, on southern Bouldin Island, and along the transmission corridor as it crosses Mandeville Island. Approximately 34 acres of the inundation and construction-related losses from CM4 would occur in the near-term throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, creating 400 acres of nontidal marsh as part of CM10 during the first 10 years of Alternative 4 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 134 acres of restoration and 134 acres of protection would be needed to offset (i.e., mitigate) the 134 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in relatively minor (6%) losses of nontidal perennial aquatic community in the study area. These losses (299 acres of permanent and 34 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), change to tidally influenced inundation during tidal marsh restoration (CM4), and floodplain restoration (CM5). The changes to tidally influenced inundation would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored. The restoration would occur over a wide region of the study area, including within the Cosumnes/Mokelumne, Yolo Bypass, South Delta and East Delta ROAs (see Figure 12-1).

NEPA Effects: During the implementation of Alternative 4 in the near-term, creating 400 acres of nontidal marsh as part of CM10 would offset the construction-related and inundation losses of 134 acres of nontidal perennial aquatic natural community. There would be no adverse effect. During the full duration of Plan implementation, Alternative 4 would not result in a net reduction in the acreage of a sensitive natural community; there would be an expansion of nontidal marsh and the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 4 would result in the loss of approximately 134 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The construction losses would occur primarily at reusable tunnel material storage sites near Twin Cities Road and on Bouldin Island, and along the transmission corridor where it crosses Mandeville Island. The losses would be spread across the near-term timeframe. These losses would be offset by planned restoration of 400 acres of nontidal marsh scheduled for the first 10 years of Alternative 4 implementation (CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 134 acres of restoration and 134 acres of protection would be needed to offset (i.e., mitigate) the 134 acres of loss. While the Plan does not include protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection. The restoration would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 333 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. The nontidal marsh would consist of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 4 would not have a substantial adverse effect on the nontidal perennial aquatic natural community; the impact would be beneficial.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation of 50–77 acres of nontidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 50-acre increase in inundation would be associated with a notch flow of 3,000 cubic feet per second (cfs), and the 77-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and patches throughout the bypass, including along the Tule Canal/Toe Drain, the western channels north of Interstate 80, and below the Fremont and Sacramento Weirs. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 25 acres of nontidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal perennial aquatic habitats as they relate to BDCP target aquatic species. The periodic flooding may also encourage germination of nontidal marsh vegetation.

In summary, 75-102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5). Nontidal perennial aquatic community in the Yolo Bypass has developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal perennial aquatic natural community in the Yolo Bypass and along south Delta waterways would not reduce the acreage of this natural community and could encourage germination of aquatic vegetation. This increased inundation would not be adverse.

CEQA Conclusion: An estimated 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. The nontidal perennial aquatic community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community

in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with CM1 (see Impact BIO-13 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 4 operations scheme would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed

surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal perennial aquatic natural community.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-4-6). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the nontidal freshwater perennial emergent wetland natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP that would improve the value of nontidal freshwater perennial emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-6. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	2	2	4	4	0	0
CM2	25	25	1	1	6–8	0
CM4	40	99	0	0	0	0
CM5	0	0	0	0	0	8
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**67**	**126**	**5**	**5**	**6–8**	**8**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 126 acres and temporarily remove 5 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 9% of the 1,509 acres of the community that is mapped in the study area. Approximately 56% (72 acres) of the permanent and temporary losses would happen during the near-term of Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration (CM10) would add 1,200 acres of nontidal marsh, consistent with BDCP Objective NFEW/NPANC1.1, and natural communities protection (CM3) would protect 50 acres of nontidal marsh, consistent with Objective TRBL1.1. These actions would be taken over the course of BDCP marsh restoration activities, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1 (Table 3.3-2 in BDCP Chapter 3, *Conservation Strategy*). The nontidal marsh protection would be designed to support tricolored blackbird populations in the study area. The analysis in Chapter 5, Section 5.4.6.2, *Beneficial Effects*, of the BDCP indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh. The restoration would occur in blocks that are contiguous with the alternative's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998).

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 4 water conveyance facilities would permanently remove 2 acres and temporarily remove 4 acres of tidal freshwater perennial emergent wetland community. The permanent losses would occur at the Clifton Court Forebay construction site and the reusable tunnel material site on Bouldin Island (see Terrestrial Biology Mapbook). The temporary loss would occur in a temporary work area and where temporary powerlines would be constructed across Mandeville Island. These wetlands are extremely small and remote water bodies, surrounded by agricultural operations. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels and Tule Canal modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in nontidal freshwater perennial emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 25 acres could be permanently lost and 1 acre could be temporarily removed. These losses would most likely occur in the Tule Canal and west side channels at the north end of the bypass. The habitat here includes narrow bands within these side channels of the bypass and is isolated from other marsh or open water habitats. The narrow bands are bordered by riparian habitats, primarily willows and cottonwoods. This activity would occur in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 99 acres of nontidal freshwater perennial emergent wetland community, primarily in the Cache Slough ROA (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored (CM10) and 50 acres would be protected (CM3) during nontidal habitat conservation actions. Approximately 400 acres of the restoration and 25 acres of the protection would happen during the first 10 years of Alternative 4 implementation, which would coincide with the timeframe of water conveyance facilities construction and early tidal marsh restoration. The remaining restoration would be spread over the following 30 years. Nontidal marsh natural communities restoration is expected to be focused in the vicinity of giant garter snake populations in the eastern Delta and near the Yolo Bypass.

- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would not affect nontidal freshwater perennial emergent wetland natural community.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the nontidal freshwater perennial emergent wetland community through CM1 construction losses (2 acres permanent and 4 acres temporary) and the CM2 construction losses (25 acres permanent and 1 acre temporary). These losses would occur at the southern forebay, along powerlines across Mandeville Island, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 during the first 10 years of Alternative 4 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 72 acres of restoration and 72 acres of protection would be needed to offset (i.e., mitigate) the 72 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in small (9%) losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (126 acres of permanent and 5 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of the CM4 restoration activities primarily at the Cache Slough ROA. By the end of the Plan timeframe, a total of

1,200 acres of nontidal marsh would be restored and 50 acres would be protected. The restoration would occur near giant garter snake occupied habitat in the eastern Delta and near Yolo Bypass, in CZs 2, 4 and 5. The 50 acres of protection would occur in CZ 1, 2, 8 or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: In the near-term, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 would offset the near-term losses associated with construction of CM1, CM2 and CM4 facilities, avoiding any adverse effect. With 1,200 acres of nontidal marsh restoration (BDCP Objective NFEW/NPANC1.1) and 50 acres of protection (BDCP Objective TRBL1.1) included with full implementation of the Plan, Alternative 4 would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 4 would result in the loss of approximately 32 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2). The construction losses would occur near Clifton Court Forebay, along transmission line construction areas on Mandeville Island, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough ROA (see Figure 12-1).The losses would be spread across the near-term timeframe. These losses would be offset by planned restoration of 400 acres and protection of 25 acres of nontidal marsh scheduled for the first 10 years of Alternative 4 implementation (CM3 and CM10). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 72 acres of restoration and 72 acres of protection would be needed to offset (i.e., mitigate) the 72 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection. The restoration and protection would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 131 acres of the natural community would be removed, 1,200 acres of nontidal marsh would be restored (BDCP Objective NFEW/NPANC1.1) and 50 acres of nontidal marsh would be protected (BDCP Objective TRBL1.1). There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 4 would not have a substantial adverse effect on the nontidal freshwater perennial emergent wetland natural community; the impact would be beneficial.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal freshwater perennial emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency and duration of inundation of 6-8 acres of nontidal freshwater perennial emergent wetland natural community. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 6-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 8-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and isolated patches along the Tule Canal and western channel in the north end of the bypass. These areas are not connected to other adjacent marsh and open water habitats; they are surrounded by riparian habitat, scoured grassland and agricultural lands. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal freshwater perennial emergent wetland plant species in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this increased inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 8 acres of nontidal freshwater perennial emergent wetland habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal freshwater perennial emergent wetland habitats as they relate to BDCP target aquatic species. The added exposure to inundation could also encourage germination of nontidal marsh plant species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, from 14-16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5). This community would not be adversely affected because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal freshwater perennial emergent wetland natural community in the Yolo Bypass and in the southern Delta would not reduce the acreage of this natural community and could encourage germination of emergent wetland vegetation. The increased inundation would not be an adverse effect.

CEQA Conclusion: An estimated 16-18 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. This community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant on the nontidal freshwater perennial emergent wetland natural community.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-16 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect the nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal freshwater perennial emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal freshwater perennial emergent wetland natural community.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of CM1, CM2 and CM4 would result in both permanent and temporary removal of this community (see Table 12-4-7). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the alkali seasonal wetland natural community.

- Protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8 and/or 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in Conservation Zones 1, 8, and/or 11 to achieve no net loss of wetted acres (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).

- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP that would improve the value of alkali seasonal wetland natural community for terrestrial species. As explained below, with the protection, restoration, and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-7. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	1	1	0	0	0	0
CM2	45	45	0	0	264–744	0
CM4	13	27	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**59**	**73**	**0**	**0**	**264–744**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. They represent the total loss of habitat that would occur over the 50-year life of the Plan. The LLT totals do not reflect the increases in habitat that would result from restoration and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2 and CM4 under Alternative 4 would permanently eliminate an estimated 73 acres of alkali seasonal wetland complex natural community in the study area. There would be no temporary impacts to alkali seasonal wetlands. These modifications represent approximately 2% of the 3,723 acres of the community that is mapped in the study area. Most of the losses (59 acres or 81%) would happen during the near-term of Alternative 4 implementation, as the water conveyance facility is constructed, the Yolo Bypass improvements are initiated, and habitat restoration is initiated. Alkali seasonal wetland complex protection (120 acres) and restoration (an estimated 58 acres, but determined by actual level of effect) would be initiated during the same period; when combined, these actions would offset the losses. By the end of the Plan period, 150 acres of this natural community would be protected and up to 73 acres would be restored. The analysis for this community in Chapter 5, Section 5.4.7.2, *Beneficial Effects*, of the BDCP states that Alternative 4 would protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, or 11, in a mosaic of protected grasslands and vernal pool complex. This would protect currently unprotected high-value alkali seasonal wetland complex in the Plan Area.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 transmission lines immediately west of Clifton Court Forebay would permanently affect 1 acres of alkali seasonal wetland complex natural community, a portion of which includes iodine bush scrub, a sensitive plant community. The alkali seasonal wetland complex at this location is scattered and significantly degraded by past agricultural and water development-related activities. It is surrounded by or adjacent to vernal pool complex natural community.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement:* Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Realignment of Putah Creek could involve excavation and grading in alkali seasonal wetland complex as a new channel is constructed. Based on hypothetical construction footprints, a total of 45 acres could be permanently lost. This complex is located immediately south of the existing Putah Creek channel within the bypass, and is a relatively large, moderate to high value, contiguous expanse of this community. This loss would occur in the near-term timeframe.

- *CM3 Natural Communities Protection and Restoration:* CM3 proposes to protect at least 150 acres of alkali seasonal wetland complex in CZ 1, CZ 8, and CZ 11 (Objective ASWNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13 acres of alkali seasonal wetland complex in the near-term and inundate or remove 27 acres by the end of the Plan timeframe. The losses would be expected to occur in the Cache Slough and Suisun Marsh ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the Lindsay Slough area and on the northern fringes of Suisun Marsh, north of the Potrero Hills. These losses would not fragment the alkali seasonal wetland communities adjacent to these sloughs because the losses would occur on the edges of the existing habitat.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the conservation measure is to match the acreage of restoration with the actual acreage lost to other conservation measures (primarily CM2 and CM4). The current estimate for alkali seasonal wetland complex restoration is 58 acres in the near-term and a total of 72 acres by the end of the BDCP restoration period. The goal is for no net loss of this natural community, consistent with BDCP Objective ASWNC1.2. Restoration in the Lindsay Slough area of the Cache Slough ROA and the northern region of the Suisun Marsh ROA would be consistent with essential habitat connectivity goals mapped in Figure 12-2 and described in Table 3.2-2 of BDCP Chapter 3, *Conservation Strategy*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the alkali seasonal wetland complex natural community through CM1 and CM2 construction losses (46 acres permanent). These losses would occur in the Yolo Bypass south of Putah Creek and on land immediately west of Clifton Court Forebay. Approximately 13 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough and Suisun Marsh ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3, the restoration of 58 acres of this community as part of CM9, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* during the first 10 years of Alternative 4 implementation would offset this near-term loss, avoiding any adverse effect. AMM30 would require that transmission line construction avoid any losses of alkali seasonal wetland complex natural community (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, for a full description of AMM30). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 118 acres of protection and 59 acres of restoration would be needed to offset (i.e., mitigate) the 59 acres of loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas.

BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in relatively minor (2%) losses of alkali seasonal wetland natural community in the study area. These losses (73 acres) would be largely associated with construction of Yolo Bypass fish improvements (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of BDCP restoration activities, primarily in the Cache Slough and Suisun Marsh ROAs.

***NEPA Effects*:** In the first 10 years of implementing Alternative 4 conservation measures, 120 acres of alkali seasonal wetland complex would be protected as part of CM3 and 58 acres of this community would be restored as part of CM9. These conservation actions would offset the near-term loss of this community associated with CM1, CM2 and CM4, avoiding any adverse effect. By the end of the Plan timeframe, Alternative 4 would protect a total of 150 acres of alkali seasonal wetland natural community (CM3) and would restore up to 72 acres (CM9). The protection and restoration would occur primarily in CZ 1, CZ 8 and/or CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Therefore, Alternative 4 would not have an adverse effect on the alkali seasonal wetland complex natural community.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 4 would result in the permanent loss of approximately 59acres of alkali seasonal wetland complex natural community due to water conveyance facility construction (CM1), to construction of fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily in the area just south of Putah Creek in the Yolo Bypass and adjacent to Clifton Court Forebay, while inundation losses would occur in the Cache Slough and Suisun Marsh ROAs. The losses would be spread across the near-term timeframe.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3, the restoration of 58 acres of this community as part of CM9, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* during the first 10 years of Alternative 4 implementation would offset this near-term loss, avoiding any significant impact. Because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 118 acres of protection and 59 acres or restoration would be needed to offset (i.e., mitigate) the 59 acres of loss. AMM1, AMM2, AMM3, AMM4, and AMM10 would also be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 73 acres of alkali seasonal wetland complex natural community would be permanently removed by conservation actions, 150 acres would be protected and up to 73 acres would be restored. The restoration acres actually developed would depend on the number of acres affected during Alternative 4 implementation. There would be no net permanent reduction in the acreage of this natural community within the study area. Therefore, Alternative 4 would have a less-than-significant impact on the alkali seasonal wetland complex natural community.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of alkali seasonal wetland complex natural community at scattered locations in the central and southern sections of the bypass.

Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency and duration of inundation on an estimated 264–744 acres of alkali seasonal wetland complex natural community. The methods used to estimate these inundation acreages are described in Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 264-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 744-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The alkali seasonal wetland complex natural community occurs primarily in the central and southern reaches of the bypass, south of Putah Creek. The stands in this location are relatively large, with moderate to high value for associated plant and wildlife species. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

***NEPA Effects*:** The modification of periodic inundation events in the Yolo Bypass associated with Alternative 4 would not adversely affect alkali seasonal wetland complex habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in plant species composition as a result of longer inundation periods, but the natural community would persist.

***CEQA Conclusion*:** An estimated 264–744 acres of alkali seasonal wetland complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 4. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of alkali seasonal wetland complex natural community in the Yolo Bypass would have a less-than-significant impact on this natural community. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 were constructed and the stream flow regime associated with changed water management was in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation in and adjacent to Plan reserves. These actions are associated with CM1 and CM11 (see Impact BIO-19 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat (see Chapter 3, Section 3.4.11 of the BDCP and Appendix 11F, Section 11F.3.2.5 of the EIR/EIS). BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *CM3 Natural Communities Protection and Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10 and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the alkali seasonal wetland complex natural community.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Initial development and construction of CM1 and CM4 would result in permanent removal of 216 acres of this community (see Table 12-4-8). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the vernal pool complex natural community.

- Protect 600 acres of existing vernal pool complex in Conservation Zones 1, 8, and 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in Conservation Zones 1, 8, and/or 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3 *Biological Goals and Objectives*, of the BDCP that would improve the value of vernal pool complex natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-8. Changes in Vernal Pool Complex Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	19	19	3	3	0	0
CM2	0	0	0	0	0–4	0
CM4	201	372	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**220**	**391**	**3**	**3**	**0–4**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1 and CM4 could permanently eliminate an estimated 391 acres and temporarily remove 3 acres of vernal pool complex natural community in the study area. These acreages are based on the proposed location of the CM1 construction footprint and a theoretical footprint for CM4 tidal marsh restoration activities. The loss of this combined 394 acres would represent approximately 3% of the 12,133 acres of the community that is mapped in the study area. An estimated 223 acres of the loss could occur during the near-term of Alternative 4 implementation, as the water conveyance facility is constructed and tidal marsh restoration is initiated. Vernal pool complex protection (400 acres) and restoration (an estimated 40 acres, with actual restoration based on level of effect) would be initiated during the first 10 years of Alternative 4 implementation to counteract the loss of habitat. By the end of the Plan period, 600 acres of this natural community would be protected and up to 67 acres would be restored. Because of the high sensitivity of this natural community and its shrinking presence in the Plan Area, avoidance and minimization measures have been built into the BDCP to eliminate the majority of this potential loss. The analysis in Chapter 5, Section 5.4.8.2, *Beneficial Effects*, of the BDCP indicates that implementation of Alternative 4 would protect at least 600 acres of vernal pool complex in Conservation Zones 1, 8, and 11 and additional vernal pool complex would be restored to achieve no net loss of this community.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of the Alternative 4 water conveyance facilities would directly affect 31 acres of vernal pool complex natural community, including 19 acres permanently affected and 3 acres temporarily affected. The permanent loss would occur along the southern edge of Clifton Court Forebay, where the forebay would be expanded to provide greater storage capacity and from the construction of transmission lines. The temporary losses would occur in a temporary work area immediately adjacent to Clifton Court Forebay (see Figure 12-1 and the Terrestrial Biology Mapbook). A portion of this habitat adjacent to Clifton Court Forebay includes iodine bush scrub, a sensitive plant community.

  Because of the close proximity of construction activity to adjacent vernal pool complex near Clifton Court Forebay, there is also the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis later in this chapter.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay and Stone Lakes National Wildlife Refuge. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay and east of the construction areas adjacent to Stone Lakes NWR. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. At Stone Lakes National Wildlife Refuge, the USFWS refuge management undertakes active invasive species control, including use of grazing. No adverse effect is expected.

- *CM3 Natural Communities Protection and Restoration:* CM3 proposes to protect at least 600 acres of vernal pool complex in CZ 1, CZ 8, and CZ 11 (BDCP Objective VPNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 tidal marsh restoration in CZs 1 and 11 (Cache Slough and Suisun Marsh ROAs; see Figure 12-1) could permanently inundate or remove 201 acres of vernal pool complex in the near-term timeframe. By the end of the Plan period, a total of 372 acres could be affected. The principal areas likely to be affected include the Cache Slough drainage just west of the Yolo Bypass and the Nurse Slough drainage just east of the Potrero Hills.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool complex restoration is 40 acres in the near-term and a total of 67 acres by the end of the BDCP restoration period. This restoration conservation measure includes a "no net loss" policy normally applied to this natural community (BDCP Objective VPNC1.2).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 could directly affect 223 acres of vernal pool complex natural community through inundation or construction-related losses in habitat from CM1 and CM4 activities. This loss would likely occur in the Cache Slough or Suisun Marsh ROAs mapped in Figure 12-1, and in the vicinity of Clifton Court Forebay (see the Terrestrial Biology Mapbook).

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of up to 40 acres of this community (including a commitment to have restoration keep pace with losses; BDCP Chapter 3, Section 3.4.9, *Conservation Measure 9*) as part of CM9 during the first 10 years of Alternative 4 implementation would partially offset this near-term loss. The Plan focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 446 acres of protection and 223 acres of restoration would be needed to offset (i.e., mitigate) the 223 acres of loss. Without additional avoidance and minimization measures to reduce the potential effect, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. In addition, because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat.

To avoid this adverse effect, the BDCP includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM30 Transmission Line Design and Alignment Guidelines.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With these AMMs in place, Alternative 4 would not adversely affect vernal pool complex natural community in the near-term.

Late Long-Term Timeframe

The late long-term effect on vernal pool complex natural community would be 391 acres of permanent and 3 acres of temporary loss. These losses would be associated with the construction of CM1 facilities in the vicinity of Clifton Court Forebay and the ongoing restoration of tidal wetland in the Cache Slough and Suisun Marsh ROAs. However, 600 acres would be protected (CM3) and up to 67 acres would be restored (CM9) through the course of Alternative 4 implementation. In addition, the avoidance and minimization measures listed above would reduce the actual loss of this community to no more than 10 wetted acres of vernal pool crustacean habitat from direct activities and 20 acres of habitat from indirect effects.

***NEPA Effects*:** The conservation measures associated with Alternative 4 include protection of 400 acres (CM3) and restoration of an estimated 40 acres (CM9) of vernal pool complex in the near-term time frame. The Plan focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). In addition, Alternative 4 includes AMM12, which limits the removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. With this and other AMMs in place, the Alternative 4 not adversely affect vernal pool complex natural community in the near-term. With these conservation measures and AMMs in effect through the entire Plan period, Alternative 4 would not have an adverse effect on the vernal pool complex natural community in the long term.

***CEQA Conclusion*:**

Near-Term Timeframe

During the 10-year near-term time frame, Alternative 4 could result in the direct loss of approximately 223 acres of vernal pool complex natural community due to inundation during tidal marsh restoration (CM4) and construction of the water conveyance facility (CM1). The losses would likely occur in the Cache Slough or Suisun Marsh ROAs, and immediately adjacent to Clifton Court Forebay.

The construction- and inundation-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community (including a commitment to have restoration keep pace with losses; Chapter 3, Section 3.4.9, *Conservation Measure 9*, in the BDCP) as part of CM9 during the first 10 years of Alternative 4 implementation would partially offset this near-term loss. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 446 acres of protection and 223 acres of restoration would be needed to offset (i.e., mitigate) the 223 acres of loss. Without additional avoidance and minimization measures to reduce the potential impact, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. However, Alternative 4 also includes AMM1, AMM2, AMM3, AMM4, AMM10, AMM12, and AMM30 to minimize impacts. AMM12 places a strict limit on the acres of wetted vernal pool crustacean habitat that can be lost to conservation actions (10 acres of direct and 20 acres of indirect loss). Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 391 acres of vernal pool complex natural community could be permanently removed and 3 acres could be temporarily removed. Through CMs 3 and 9, 600 acres of vernal pool complex natural community would be protected and up to 67 acres would be restored. In addition, AMM12 would limit the acres of wetted vernal pool crustacean habitat loss to 10 acres from direct actions and 20 acres from indirect actions. This is equivalent to the direct loss of 67 acres and the indirect loss of 134 acres of vernal pool complex natural community. There would be no net permanent reduction in the acreage of this natural community within the study area. Alternative 4 would have a less-than-significant impact on this natural community.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation/flooding regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, could increase periodic inundation of a small acreage of vernal pool complex natural community in the southern section of the bypass, south of Putah Creek.

Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation on an estimated 0–4 acres of vernal pool complex natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 4-acre increase in inundation would only occur at the highest modeled flow regime, 8,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years.

The vernal pool complex natural community that would likely be affected occurs in the southern reaches of the bypass, south of Putah Creek. There are several relatively large, contiguous areas of vernal pools on the western edge of the bypass in this area. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 4 water operations would not adversely affect vernal pool complex habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential, however, for some change in plant species composition as a result of longer inundation periods.

CEQA Conclusion: An estimated 0–4 acres of vernal pool complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 4. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of vernal pool complex natural community in the Yolo Bypass would have a less-than-significant impact on the community.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation activities in Plan preserves. These actions are associated with CM1 and CM11 (see Impact BIO-22 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the major Sacramento River system and Delta waterways.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as part of *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* describes this program and identifies applicable restrictions on recreation that might adversely affect vernal pool habitat (see BDCP Chapter 3, Section 3.4.11, and Appendix 11F, Section 11F.3.2.5, of the EIR/EIS). BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, AMM37, and AMM30. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation or damage from recreational activity. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12, AMM37, and AMM30 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the vernal pool complex natural community.

Managed Wetland

The conservation components of Alternative 4 would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-4-9). Full implementation of Alternative 4 would also include the following conservation action over the term of the BDCP to benefit the managed wetland natural community.

- Protect and enhance 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 320 acres of managed wetlands consisting of greater sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in Conservation Zones 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events (Objective GSHC1.3, associated with CM10).
- Create two wetland complexes within the Stone Lakes NWR refuge boundary. Each complex will consist of at least three wetlands totaling 90 acres of greater sandhill crane roosting habitat. One of the wetland complexes may be replaced by 180 acres of cultivated lands that are flooded following harvest for crane roosting and foraging habitat (Objective GSHC1.4, associated with CM10).

In addition to this conservation action, creation of similar habitat values by restoring tidal brackish emergent wetland and tidal freshwater emergent wetland as part of CM4 would further offset the losses of managed wetland. The net effect would be a substantial decrease in the amount of managed wetland, but an increase in similar habitat value for special-status and common species as the managed wetland is converted to tidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to Impacts BIO-178 through BIO-183 in the *Shorebirds and Waterfowl* discussion at the end of this section (Section 12.3.3.9) for further consideration of the effects of removing managed wetland natural community.

Table 12-4-9. Changes in Managed Wetland Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	16	16	25	25	0	0
CM2	24	24	44	44	931–2,612	0
CM4	5,718	13,746	0	0	0	0
CM5	0	0	0	0	0	6
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**5,758**	**13,786**	**69**	**69**	**931–2,612**	**6**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 13,786 acres of managed wetland in the study area. This modification represents approximately 19% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur over the course of BDCP restoration activity, as construction and tidal marsh restoration proceed. Managed wetland protection (8,100 acres) and restoration (500 acres) would take place over the same period, but would not replace the acreage lost. The analysis in Chapter 5, Section 5.4.9.2, *Beneficial Effects*, of the BDCP states that at least 8,100 acres of managed wetlands would be protected, of which at least 1,500 acres would be located within the Grizzly Island marsh complex, consistent with the U.S. Fish and Wildlife Service salt marsh harvest mouse recovery plan. Although the primary purpose of the 1,500 acres of protection is to protect and enhance habitat for the salt marsh harvest mouse, it is also expected to benefit the managed wetland natural community and the diversity of species that use it, including migratory waterfowl and the western pond turtle.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 water conveyance facilities would permanently remove 16 acres and temporarily remove 25 acres of managed wetland community. The permanent losses would occur near the northeast corner of Clifton Court Forebay for the construction of a permanent shaft location and a permanent access road on Bouldin Island. Temporary impacts would occur in association with temporary work areas for a concrete batch plant on Mandeville Island and the reusable tunnel material conveyor facility near Clifton Court Forebay (see Terrestrial Biology Mapbook). Smaller losses would occur from construction of the temporary transmission lines that parallel the tunnel alignment northwest of the intermediate forebay and across the length of Mandeville Island. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities that could permanently or temporarily remove managed wetland, including west side channels modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in managed wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently removed and 44 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13,746 acres of managed wetland community. These losses would be expected to occur primarily in the Suisun Marsh ROA, but could also occur in the Cache Slough and West Delta ROAs (see Figure 12-1). These acres of managed wetland would be converted to natural wetland, including large acreages of tidal brackish emergent wetland and tidal freshwater emergent wetland. These natural wetlands provide comparable or improved habitat for the special-status species that occupy managed wetland. The newly created tidal marsh would not create a barrier or result in fragmentation of managed wetland, as most species are capable of utilizing both communities. An estimated 500 acres of managed wetland would be restored and 8,100 acres would be enhanced and protected through *CM3 Natural Communities Protection and Restoration*, as established by BDCP Objective MWNC1.1 All of the restoration and 4,800 acres of the protection would happen during the first 10 years of Alternative 4 implementation, which would coincide with the timeframe of water conveyance facilities construction and early implementation of CM4. The remaining restoration would be spread over the following 30 years. Managed wetland restoration is expected to include at least 320 acres in CZ 3, CZ 4, CZ 5, and CZ 6 (Figure 12-1) to benefit sandhill crane, as stated in BDCP Objective GSHC1.3. The enhancement and protection would be focused in Suisun Marsh, but could also occur in CZs with existing managed wetland (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and CZ 7).

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would permanently remove 5,758 acres and temporarily remove 69 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Sixteen acres of the permanent loss and 25 acres of the temporary loss would be associated with construction of the water conveyance facilities (CM1). These near-term losses would occur in various locations, but the majority would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 500 acres (CM10) and protection and enhancement of 4,800 acres (CM3) of managed wetland during the first 10 years of Alternative 4 implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 41 acres of protection would be needed to offset the 41 acres of loss associated with CM1 (permanent and temporary); a total of 5,827 acres of protection would be needed to offset (i.e., mitigate) the 5,827 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 527 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 4, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be an adverse effect when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this adverse effect. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

Late Long-Term Timeframe

At the end of the Plan period, 13,855 acres of managed wetland natural community would be permanently and temporarily removed by construction and restoration actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland.

NEPA Effects: Alternative 4 would result in a loss 13,855 acres of managed wetland within the study area; however, it would also protect and enhance 8,100 acres and restore 500 acres of this habitat. In addition, Alternative 4 would restore 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland that support similar ecological functions to those of managed wetland. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion:

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would permanently remove 5,758 acres and temporarily remove 69 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Sixteen acres of permanent loss and 25 acres of temporary loss would be associated with construction of the water conveyance facilities (CM1) in various locations. The majority of the near-term loss would be in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 and CM10 during the first 10 years of Alternative 4 implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 41 acres of protection would be needed to offset the 41 acres of loss associated with CM1; a total of 5,827 acres of protection would be needed to offset (i.e., mitigate) the 5,827 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 527 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section (Section 12.3.3.9).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 4, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be a significant impact when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this significant impact. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the impacts of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Late Long-Term Timeframe

At the end of the Plan period, 13,855 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland. Because these natural wetlands support similar ecological functions to those of managed wetland, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of managed wetland on wildlife management areas and duck clubs scattered up and down the central and southern bypass. CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways in the south Delta.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation of 931-2,612 acres of managed wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 931-acre increase in inundation would be associated with a notch flow of 8,000 cubic feet per second (cfs), and the 2,612-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Based on the theoretical modeling that has been completed to-date, the largest acreages would be associated with the Sacramento Bypass Wildlife Area, the Yolo Bypass Wildlife Area, and private managed wetlands south of Putah Creek. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). With larger flows, the water depths may also increase over Existing Conditions. While the managed wetlands of the Yolo Bypass are conditioned to periodic inundation events, the more frequent and extended inundation periods may make it more difficult to actively manage the areas for maximum food production for certain species (waterfowl primarily) and may alter the plant assemblages in some years. The effects of this periodic inundation on birds and other terrestrial species are discussed later in this chapter. The additional inundation would not be expected to reduce the acreage of managed wetland on a permanent basis. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency, magnitude and duration of inundation of an estimated 6 acres of managed wetland. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The connection of these wetlands to stream flooding events would be beneficial to the ecological function of managed wetlands, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The more frequent flooding would periodically interfere with management activities associated with terrestrial species (primarily waterfowl) and may result in changes in plant composition and management strategies over time.

In summary, 937–2,6181 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5).

NEPA Effects: Managed wetland community would not be adversely affected because much of the acreage affected is conditioned to periodic inundation. The more frequent inundation could create management problems associated with certain species, especially waterfowl, and result in changes over time in plant species composition. The total acreage of managed wetland would not be expected to change permanently as a result of the periodic inundation.

CEQA Conclusion: An estimated 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. Managed wetland community would not be significantly impacted because periodic inundation is already experienced by most of the land that would be affected. There could be increased management problems and a long-term shift in plant species composition. The periodic inundation would not be expected to result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include changes in operation of upstream reservoirs, the diversion of Sacramento

River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use managed wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow hunting, fishing and hiking in managed wetland reserve areas. *CM11 Natural Communities Enhancement and Management* describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat (see BDCP Chapter 3, Section 3.4.11 and Appendix 11F, Section 11F.3.2.5, of the EIR/EIS). BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management, and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration, CM4 Tidal Natural Communities Restoration,* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in acreage of managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration and CM4 Tidal Natural Communities Restoration,* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the managed wetland natural community.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7 (Figure 12-1). The only BDCP conservation component that would potentially affect this natural community is the seasonally inundated floodplain restoration conservation measure (CM5) (see Table 12-4-10).

Table 12-4-10. Changes in Other Natural Seasonal Wetland Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	0	0	0	0	0	0
CM5	0	0	0	0	0	2
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**2**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Based on theoretical footprints for this activity, *CM5 Seasonally Inundated Floodplain Restoration* could expose 2 acres of other natural seasonal wetland community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels, including the channels of Old River and Middle River. Several small patches of other natural seasonal wetland natural community are mapped along these waterways. The exposure of these seasonal wetlands to increased but infrequent episodes of stream flooding would not alter their ecological function or species composition. Their value to special-status and common plants and wildlife in the study area would not be affected. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

NEPA Effects: Alternative 4 conservation actions would not adversely affect other natural seasonal wetland natural community because the small increase in periodic flooding of up to 2 acres would not alter its function or general species makeup.

CEQA Conclusion: An estimated 2 acres of other natural seasonal wetland community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing CM5 under Alternative 4. This community would not be significantly impacted because a small increase in periodic flooding would not alter its ecological function or species composition. The periodic inundation would not result in a net permanent reduction in the acreage of this community

in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental*

Commitments, AMMs, and CMs. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared to the restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool complex conservation measure includes restoration of 139 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the other natural seasonal wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the other natural seasonal wetland natural community.

Grassland

Construction, operation, maintenance and management associated with the conservation components of Alternative 4 would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would result in both permanent and temporary removal of this community (see Table 12-4-11). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the grassland natural community.

- Protect 8,000 acres of grassland with at least 2,000 acres protected in Conservation Zone 1, at least 1,000 acres protected in Conservation Zone 8, and at least 2,000 acres protected in Conservation Zone 11 (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland and to provide upland habitat adjacent to riparian, tidal, and nontidal natural communities for wildlife foraging and upland refugia (Objective GNC1.2, associated with CM3 and CM8).
- Of the 8,000 acres of grassland protected and at least 2,000 acres of grassland restored, protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide 200 feet of adjacent grasslands beyond the sea level rise accommodation (Objective GNC1.4, associated with CM3 and CM8).

There is a variety of other, less specific conservation goals and objectives in Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP that would improve the value of grassland natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-11. Changes in Grassland Natural Community Associated with Alternative 4 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	467	467	158	158	0	0
CM2	388	388	239	239	385–1,277	0
CM4	448	1,122	0	0	0	0
CM5	0	51	0	34	0	514
CM6	Unk.	Unk.	Unk.	Unk.	0	0
CM7	4	410	0	0	0	0
CM11	13	50	0	0	0	0
CM18	35	35	0	0	0	0
TOTAL IMPACTS	**1,355**	**2,523**	**397**	**431**	**385–1,277**	**514**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
Unk. = unknown

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would permanently eliminate an estimated 2,523 acres and temporarily remove 431 acres of grassland natural community in the study area. These modifications represent approximately 4% of the 78,047 acres of the community that is mapped in the study area. Approximately60% (1,752 acres) of the permanent and temporary losses would happen during the near-term time period of Alternative 4 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Grassland protection (2,000 acres), restoration (1,140 acres) and enhancement would be initiated during the same period. By the end of the Plan period, 2,000 acres of this natural community would be restored and 8,000 acres would be protected. The analysis for grassland in Chapter 5, Section 5.4.11.2, *Beneficial Effects*, of the BDCP indicates that 8,000 acres of grasslands would be protected in Conservation Zones 1, 2, 4, 5, 7, 8, and 11, and 2,000 acres of grassland would be restored. Grassland protection and restoration would improve connectivity among habitat areas in and adjacent to the Plan Area, improve genetic interchange among native species' populations, and contribute to the long-term conservation of grassland-associated covered species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 water conveyance facilities would permanently remove 467 acres and temporarily remove 158 acres of grassland natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland; construction of the intermediate forebay; a reusable tunnel material storage site on Bouldin Island; at a permanent pipeline shaft access road on the east side of Bacon Island; and at various permanent facility sites around Clifton Court Forebay, including a reusable tunnel material storage site, new canal connections from Clifton Court Forebay to the two aqueducts, and in the forebay expansion area on the south side of the existing forebay. Most of the permanent losses would be of ruderal and herbaceous grassland areas that exist in very narrow bands adjacent to waterways, levees and roads (see Terrestrial Biology Mapbook). Some of the grassland lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland. A portion of the grassland habitat adjacent to Clifton Court Forebay includes iodine bush scrub, a sensitive plant community. The temporary losses would be associated with construction of the pump stations and temporary access roads along the Sacramento River; at work areas and barge offloading facility construction sites at the south end of Bouldin Island, at the north end of Bacon Island, and the south end of Venice Island and at the northwest corner of Victoria Island; at temporary access road sites on the northern and southern ends of Bacon Island and the northwest corner of Victoria Island; at temporary work areas on Mandeville and Bacon Islands; at the operable barrier construction site at the head of Old River, and various locations around Clifton Court Forebay. These losses would take place during the near-term construction period.

  The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction in and around the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Toe Drain/Tule Canal and Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in grassland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 388 acres could be permanently lost and another 239 acres could be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir where a large expanse of grassland is present, along the Toe Drain/Tule Canal, and along the west side channels. These grasslands are composed primarily of upland annual grassland and forbs. Some of this grassland removal along the side channels of the bypass could pose barriers to grassland species moving within the bypass. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 448 acres of grassland in the near-term and inundate or remove 1,122 acres of grassland by the end of the Plan timeframe. The losses would occur in a number of ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Most of this grassland is ruderal and herbaceous vegetation with low habitat value; some of the larger patches of grassland in the Cache Slough ROA are annual grassland with higher values.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 51 acres and temporarily remove 34 acres of grassland natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). The grassland in this area is primarily composed of narrow bands and small patches of ruderal herbaceous grasses and forbs. This activity is scheduled to start following construction of water conveyance facilities.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM7 Riparian Natural Community Restoration*: Riparian natural community restoration would occur in a variety of settings in the Plan Area, with an emphasis on improving connectivity of existing riparian areas and stream/river corridors, to benefit the movement and interchange of special-status and common species that use these areas. Large tracts would be restored in concert with floodplain restoration (CM5), while narrower bands would be developed as part of channel margin enhancement (CM6) and tidal marsh restoration (CM4). In the process of expanding woody riparian habitat, existing nonnative grassland would be removed. While specific locations for these restoration activities have not been fully developed, use of theoretical footprints for this activity indicate that up to 410 acres of grassland could be lost through the course of Plan implementation. A majority of this activity would occur in the South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).

- *CM8 Grassland Natural Community Restoration*: The grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZ 1, CZ 8, and CZ 11, as proposed by BDCP Objective GNC1.1 (Figure 12-1), with a goal of improving habitat connectivity and increasing the diversity of grassland species (Objective GNC1.2). Some of the planned 2,000 acres of restoration would occur around existing populations of giant garter snake in the east Delta and the Yolo Bypass area.

- *CM11 Natural Communities Enhancement and Management*: Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the BDCP. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public's ability to participate in recreational activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known, so the analysis of this activity is programmatic. At the current level of planning, it is assumed that the trail system would be located entirely in grassland habitats and would include up to 50 acres of habitat loss.
- *CM18. Conservation Hatcheries*: The BDCP includes a proposal to design and construct a conservation hatchery to maintain populations of delta smelt and longfin smelt. The location of this facility is not yet firmly established, but for planning purposes it has been assumed that it would be constructed in the vicinity of Rio Vista and would be located in grassland habitat. The grassland in the Rio Vista area includes both California annual grassland and ruderal herbaceous grasses and forbs. The current estimate of the land needed for this facility is 35 acres.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe, Alternative 4 would affect the grassland natural community through CM1 construction losses (467 acres permanent and 158 acres temporary), CM2 construction losses (388 acres permanent and 239 acres temporary), CM11 recreational trail construction (13 acres permanent), CM18 fish hatchery construction (35 acres permanent), and CM7 riparian habitat restoration (4 acres permanent). These losses would occur along the eastern bank of the Sacramento River at intake sites, adjacent to Clifton Court Forebay associated with forebay expansion, at various permanent and temporary construction sites for barge unloading facilities and tunnel shaft sites through the central Delta, at currently unspecified sites for hatchery and recreational trail construction and riparian restoration, at fish passage construction sites in the northern Yolo Bypass, and along the east and west channels within the Yolo Bypass. Approximately 448 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These tidal restoration losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see BDCP Chapter 3, *Conservation Strategy*). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses later in this chapter. In addition, the loss of iodine bush scrub located in grassland adjacent to Clifton Court Forebay would be an adverse effect. The combination of restoring 1,140 acres (CM8) and protecting 2,000 acres (CM3) of grassland natural community during the first 10 years of BDCP implementation, and the commitment to restore temporarily affected grassland (397 acres) to its pre-project condition within one year of completing construction as required by *AMM10*

Restoration of Temporarily Affected Natural Communities, would offset this near-term loss, avoiding any loss in the value of this habitat for special-status species. The restoration of grassland would include protection in perpetuity, and the protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (CM3 and CM11). Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,504 acres of protection would be needed to offset (i.e., mitigate) the 1,752 acres of combined permanent and temporary loss. The combination of restoration and protection, along with the enhancement and management associated with CM3 and CM11 contained in the BDCP, is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species. In addition, because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 4 as a whole would result in less than 4% losses of grassland natural community in the study area. These losses (2,523 acres of permanent and 431 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and riparian habitat restoration (CM7). Inundation losses would occur through the course of BDCP restoration activities at various tidal restoration sites throughout the study area.

***NEPA Effects*:** By the end of the Plan timeframe, a total of 2,000 acres of this natural community would be restored (CM8) and 8,000 acres would be protected (CM3). The restoration would occur primarily in CZ 1, CZ 8, and CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity. The 2,000 acres of restoration associated with CM8, and the restoration of temporarily affected grassland required by AMM10 (431 acres for Alternative 4) would not totally replace the grassland acres lost through the Plan timeframe (2,954 acres). There would be a permanent loss of 523 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 4 would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

***CEQA Conclusion*:**

Near-Term Timeframe

Alternative 4 would result in the loss of approximately 1,752 acres of grassland natural community due to construction of the water conveyance facilities (CM1), fish passage improvements (CM2), riparian habitat restoration (CM7), recreational trail development (CM11), fish hatchery construction (CM18), and inundation during tidal marsh restoration (CM4). The construction losses would occur along the eastern bank of the Sacramento River at intake sites, adjacent to Clifton Court Forebay associated with forebay expansion, at various permanent and temporary construction sites for barge unloading facilities and tunnel shaft sites through the central Delta, at currently unspecified sites for hatchery and recreational trail construction and riparian habitat restoration, at fish passage improvement sites in the northern Yolo Bypass, and along the east and west channels within the Yolo Bypass. Inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across the near-term timeframe.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Nonetheless, these losses would be offset by planned restoration of 1,140 acres and protection of 2,000 acres of grassland natural community scheduled for the first 10 years of Alternative 4 implementation, and the restoration of temporarily affected grassland (397 acres for Alternative 4) as dictated by AMM10. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,504 acres of protection would be needed to offset (i.e., mitigate) the 1,752 acres of loss. The combination of two approaches (protection and restoration) contained in the BDCP conservation measures and avoidance and minimization measures is designed to avoid a temporal lag in the value of grassland habitat available to special-status species. The protection and restoration would be initiated at the beginning of Alternative 4 implementation to minimize any time lag in the availability of this habitat to special-status species.

Late Long-Term Timeframe

At the end of the Plan period, 2,954 acres of grassland natural community would be permanently or temporarily removed by conservation actions, 2,000 acres would be restored and 8,000 acres would be protected. Temporarily affected areas would also be restored (431 acres for Alternative 4). While there would be a net permanent reduction in the acreage of this natural community within the study area (total loss of 523 acres), there would be an increase in the value of grassland for special-status and common species in the study area through the combination of conservation actions (CM3 and CM8) and avoidance and minimization measures (AMM1, AMM2, AMM6, AMM7, and AMM10). Therefore, Alternative 4 would have a less-than-significant impact on this natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Two Alternative 4 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of grassland natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 4 would result in an increase in the frequency, magnitude and duration of inundation of 385–1,277 acres of grassland natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 385-acre increase in inundation would occur at the 1,000 cfs flow regime, while the 1,277-acre increase would occur at the 4,000 cfs flow regime. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The grassland community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass, in stringers along the internal waterways of the bypass and in larger patches in the lower bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect grassland habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in grass species composition as a result of longer inundation periods. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 514 acres of grassland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The increase in periodic stream flooding events would not adversely affect the habitat values and functions of grassland natural community.

In summary, 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 4 conservation measures (CM2 and CM5).

NEPA Effects: The grasslands in the Yolo Bypass and along river floodplains in the south Delta are conditioned to periodic inundation from flood flows; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would not constitute an adverse effect.

CEQA Conclusion: An estimated 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 4. The grassland natural community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would have a less-than-significant impact on the community.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with CM1 (see Impact BIO-30 for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Community Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4 intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.
- *Habitat enhancement.* The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM8 Grassland Natural Community Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4 would not result in a net permanent reduction in grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4 would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM8 Grassland Natural Community Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the grassland natural community.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community consists of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1). While inland dune scrub is within the BDCP Plan Area, none of the Alternative 4 conservation measures or covered actions is expected to affect this community.

Cultivated Lands

Cultivated lands is the major land cover type in the study area (487,106 acres, see Table 12-1in Section 12.2.2.2, *Special-Status and other Natural Communities*). The Delta, the Yolo Bypass, and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 list special-status wildlife species supported by cultivated lands.

The effects of Alternative 4 on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species in this chapter also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses, there is no separate analysis of this land cover type presented here. Table 14-8 in Chapter 14 provides a comparison of important farmland losses that would result from construction of CM1 water conveyance facilities for each alternative, and Table 14A-1 in Appendix 14A, *Individual Crop Effects as a Result of BDCP Water Conveyance Facility Construction*, provides a similar comparison for losses of individual crops. For Alternative 4, the total loss (permanent and temporary) is estimated to be 58,379 acres. The majority of the permanent loss would be associated with habitat restoration activities, specifically Yolo Bypass fisheries enhancement (CM2; 629 acres), tidal marsh restoration (CM4; 39,565 acres), floodplain restoration (CM5; 2,087 acres), riparian natural community restoration (CM7; 4,553 acres), grassland restoration (CM8; 2,000 acres) and nontidal marsh restoration (CM10; 1,950 acres). Construction of the modified tunnel and associated water conveyance facilities (CM1) would permanently remove 4,699 acres of cultivated lands.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized as developed lands (90,660 acres). Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities (see Figure 12-1 and the Terrestrial Biology Mapbook). Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap provide giant garter snake habitat.

As with cultivated lands, no effort has been made to analyze the effects of Alternative 4 conservation measures on this land cover type because it is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but which do not include topographic depressions that are characteristic of vernal pool crustacean habitat.

Construction and restoration associated with Alternative 4 conservation measures would result in permanent losses (see Table 12-4-12) and indirect conversions of vernal pool crustacean modeled habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit vernal pool crustaceans (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (Objective VPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)
- Protect one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-12. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	13	13	1	1	NA	NA
	Low-value	7	7	2	2	NA	NA
Total Impacts CM1		**20**	**20**	**3**	**3**	**NA**	**NA**
CM2–CM18 [b]	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**221**	**392**	**3**	**3**	**0–4**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 4 conservation measures would result in the direct, permanent loss of up to 392 acres of modeled vernal pool crustacean habitat from conveyance facilities construction (CM1) and tidal restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 177 acres of vernal pool crustacean habitat (132 acres of high-value habitat and 45 acres of low-value habitat) from conveyance facilities construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 4 would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool fairy shrimp (455 acres), and vernal pool tadpole shrimp (270 acres). The hypothetical tidal restoration (CM4) footprints in CZ 11 account for all of the effects on critical habitat for Conservancy fairy shrimp and vernal pool tadpole shrimp. Vernal pool fairy shrimp critical habitat would also be affected by CM4 in this same area and would be affected by conveyance facilities construction (CM1) west of Clifton Court Forebay. *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species in association with restoration projects in CZ 1 and CZ 11.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the covered vernal pool crustaceans. As specified in *AMM12 Vernal Pool Crustaceans* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines are designed avoid removal of wetted acres of aquatic habitats to the maximum extent practicable. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involve an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent and temporary combined loss of approximately 23 acres of vernal pool crustacean habitat, composed of 14 acres of high -value and 9 acres of low-value habitat (Table 12-4-12). The construction of the conveyance facilities would result in the permanent loss of one vernal pool fairy shrimp CNDDB occurrence as a result of the expansion of Clifton Court Forebay. In addition, conveyance facility construction could result in the indirect conversion of 42 acres of high quality vernal pool crustacean habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, from the storage of RTM, and permanent access roads. There are records of vernal pool fairy shrimp and midvalley fairy shrimp in the vicinity of these areas (California Department of Fish and Game 2012). Alternative 4 would also result in the permanent loss of 185 acres of critical habitat for vernal pool fairy shrimp. The permanent impacts on critical habitat are associated with the RTM disposal areas and an associated access road west of Clifton Court Forebay (177 acres), a new transmission line (5 acres), and upgrades to a permanent access road just south of this area (3 acres). The RTM disposal areas have been mapped by the BDCP as mostly cultivated lands with the more eastern portion mapped as grasslands. Existing roads would serve as the permanent access roads, so there likely would be minimal disturbance to vernal pool crustacean habitat associated with any improvements to this road. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines are designed to avoid removal of aquatic habitats to the maximum extent feasible.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool crustacean habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery of these habitats found that they appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool crustaceans as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Game 2012). Helm (1998) notes that many vernal pool crustaceans can occur in degraded vernal pool habitats and artificial habitats. In CZ 2 and CZ 4, there are several records of covered vernal pool crustaceans occurring outside of modeled habitat in areas that appear to be road side ditches. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool crustaceans and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool crustacean habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool crustacean habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. The hypothetical restoration footprints overlap with a CNDDB record for vernal pool fairy shrimp near the current edge of Suisun Marsh. Tidal natural community restoration under Alternative 4 would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool tadpole shrimp (270 acres), and vernal pool fairy shrimp (270 acres). *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool crustaceans. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-4-13 was prepared to further analyze BDCP effects on vernal pool crustaceans using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, and *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of habitat. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4-13. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 4 (acres)

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 4 Impact[b]	CM1	3.5	3.5	6.3	6.3
	CM4[c]	30.2	55.8	11.0	20.3
Total		**33.7**	**59.3**	**17.3**	**26.6**

[a] Because roughly half of the impacts would occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-4-12 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool crustacean habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4-12 lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design projects to minimize or avoid effects on covered vernal pool crustaceans (see AMM12 and AMM30). As seen in Table 12-4-13, Alternative 4 would not meet the Plan's near-term biological goals and objectives for direct loss and indirect conversion unless near-term projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 3.5 wetted acres of vernal pool crustacean habitat (or 23 acres of vernal pool complex) should be restored and 19.6 wetted acres (or 131 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. With the implementation of AMM30, the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay. Assuming that the BDCP would apply the impact limits presented in Table 12-4-13 and implement AMM30, direct impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to not exceed 1.5 acres of direct effects on wetted vernal pool crustacean habitat (5 acre limit minus the 3.5 acres from CM1) and indirect impacts from tidal restoration could not exceed 3.7 wetted acres (10 acre limit minus the 6.3 acres from CM1). The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5.1 wetted acres (34 acres of vernal pool complex) and protect up to 30 wetted acres (2:1 protection for 5.1 acres of direct and 10 acres of indirect impact) (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-4-13 and discussed above, the effects of CM1 alone would be within the near-term limits, but overall Alternative 4 would not meet the

Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to a late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

NEPA Effects: The near-term loss of vernal pool crustacean habitat under Alternative 4 would not be adverse under NEPA because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the modification of vernal pool crustacean habitat and potential mortality of a special-status species resulting from Alternative 4 in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management and enhancement would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the BDCP permit term. Considering these commitments, losses and conversion of vernal pool crustacean habitat under Alternative 4 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-4-12 above lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans (see AMM12 and AMM30). As seen in Table 12-4-13, Alternative 4 would not meet the

Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 3.5 wetted acres of vernal pool crustacean habitat (or 23 acres of vernal pool complex) should be restored and 19.6 wetted acres (or 131 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on vernal pool crustacean habitat. With the implementation of AMM30, the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay. Assuming that the BDCP would apply the impact limits presented in Table 12-4-13 and implement AMM30, direct impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to not exceed 1.5 acres of direct effects on wetted vernal pool crustacean habitat and indirect impacts could not exceed 3.7wetted acres. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5.1 wetted acres (34 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of SpoilsAMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-4-13, the effects of CM1 alone would be within the near-term limits, but overall Alternative 4 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

The effects on vernal pool crustacean habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the time BDCP permit term. Considering these commitments, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 4 would have a less-than-significant impact on vernal pool crustaceans.

Impact BIO-33: Indirect Effects of Plan Implementation on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the BDCP permit term.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the BDCP permit term. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the BDCP permit term. The indirect effects of Alternative 4 on vernal pool crustacean habitat would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the BDCP permit term. The indirect impacts of Alternative 4 would be less than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass under *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled vernal pool crustacean habitat (Table 12-4-12). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration.*

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect vernal pool crustaceans occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus not be adverse under NEPA.

CEQA Conclusion: Alternative 4 would periodically inundate at most 4 acres of vernal pool crustacean habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of vernal pool crustacean habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus result in less-than-significant impacts on the species.

Valley Elderberry Longhorn Beetle

The habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (vernal pool complexes and grasslands within 200 feet of channels). Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-4-14. The majority of the losses would take place over an extended period of time as the restoration conservation measures are being implemented. In addition, an estimated 14 elderberry shrubs that were previously mapped by DWR in the DHCCP Conveyance Planning Area could be impacted by the Alternative 4 conveyance alignment (CM1). Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit valley elderberry longhorn beetle (BDCP Chapter 3, *Conservation Strategy*).

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines for the species (Objective VELB1.1).
- Site elderberry longhorn beetle habitat restoration adjacent to occupied habitat (Objective VELB1.2).
- Restore 5,000 acres of valley/foothill riparian (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of valley/foothill riparian (Objective VFRNC1.2, associated with CM3).
- Maintain or increase the abundance and distribution of rare or uncommon vegetation alliances, such as *Sambuca nigra* (blue elderberry stands) alliance (Objective VFRNC3.1, associated with CM7 and CM11).

As explained below, with the restoration or protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-14. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	37	37	24	24	NA	NA
	Non-riparian	201	201	87	87	NA	NA
Total Impacts CM1		**238**	**238**	**111**	**111**	**NA**	**NA**
CM2–CM18	Riparian	381	678	76	111	44–80	266
	Non-riparian	142	311	94	108	103–244	287
Total Impacts CM2–CM18		**523**	**989**	**170**	**219**	**161–325**	**553**
TOTAL IMPACTS		**761**	**1,227**	**281**	**330**	**161–325**	**553**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 4 conservation measures would result in the permanent and temporary loss combined of up to 1,557 acres of modeled valley elderberry longhorn beetle habitat (850 acres of riparian habitat and 707 acres of nonriparian habitat), and an estimated 14 elderberry shrubs from CM1, which represent potential habitat for the species (Table 12-4-14). Due to the limitation of the habitat suitability model, the effects on modeled habitat are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Timely implementation of the near-term habitat protection and restoration contained in the Plan and implementation of AMMs committed to in the Plan would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent and temporary combined loss of approximately 370 acres of modeled valley elderberry longhorn beetle habitat, composed of 61 acres of riparian habitat and 288 acres of nonriparian habitat (Table 12-4-14). In addition, an estimated 14 shrubs could be removed as a result of conveyance facilities construction. As noted in Section 12.3.2.3, *Methods Used to Assess Species Effects*, elderberry shrubs were mapped in the DHCCP Conveyance Planning Area where accessible and thus the entire footprint of CM1 was not surveyed. In many cases, the data collected did not always specify the number of shrubs observed but rather the size class and a range of stem numbers. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 111 acres of modeled valley elderberry longhorn beetle habitat (24 acres riparian and 87 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, reusable tunnel material storage areas, geotechnical boring areas, temporary access roads, and staging areas.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 295 acres of modeled valley elderberry longhorn beetle habitat, composed of 159 acres of riparian habitat and 136 acres of nonriparian habitat. Approximately 125 acres of permanent impacts (83 acres of riparian and 41 acres of nonriparian) would mostly occur at the north end of the Yolo Bypass from Fremont Weir improvements. The 170 acres of temporary impacts (76 acres of riparian and 94 acres of nonriparian) would mostly be from work on the Fremont Weir, the Sacramento Weir, and levees along the Bypass. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee modification, and removal of riprap and other protections from channel banks.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 813 acres of modeled valley elderberry longhorn beetle habitat, composed of 552 acres of riparian and 260 acres of nonriparian habitat. The majority of these impacts would be associated with tidal restoration in the Delta and only 42 acres of these impacts (all nonriparian) would be from tidal restoration in Suisun Marsh. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 101 acres of valley elderberry longhorn beetle habitat, composed of 78 acres of riparian and 23 acres of nonriparian. Approximately half of these impacts (52 acres) would be permanent impacts from levee construction and the other half (49 acres) would be temporary impacts associated with the levee construction. There is one CNDDB record of valley elderberry longhorn beetle occurring in CZ 7 just west of Middle River on Union Island. This record and other elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of BDCP protected habitats for covered species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Operations and maintenance: Post-construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 4 would result in permanent and temporary impacts on 1,042 acres of modeled habitat (518 acres of riparian and 524 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres of riparian and 288 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). These conservation measures (CM2 and CM4) account for 457 of the 518 acres (88%) of impacts on riparian habitat. Based on the DHCCP survey data of the Conveyance Planning Area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), an estimated 14 elderberry shrubs would be impacted in the near-term by CM1 (see Section 12.3.2.3, *Methods Used to Assess Species Effects,* for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified as habitat for valley elderberry longhorn beetle in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 61 acres of the riparian habitat should be restored/created and 61 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and losses from other conservation measures, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS (1999) conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of CM7 *Riparian Natural Community Restoration*. CM7 *Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS (1999) conservation guidelines. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals and the additional species specific measures within CM7 satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigating the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 1,557 acres of modeled valley elderberry longhorn beetle habitat (850 acres of riparian habitat and 707 acres of nonriparian habitat)during the BDCP permit term (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. Other factors relevant to effects on valley elderberry longhorn beetle include:

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat during the near-term evaluation period because most of the affected riparian vegetation would be removed during the near-term timeframe, while large quantities of riparian habitat would not be restored until the early and late long-term timeframes. Effects on valley elderberry longhorn beetle of this temporal loss of riparian vegetation are expected to be minimal because much of the riparian habitat in the Plan Area is not known to be currently occupied by the species, because all elderberry shrubs that

are suitable for transplantation would be moved to conservation areas in the Plan Area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the Plan Area and thus are likely to provide no or low-value habitat for the beetle.

- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the conservation measures or other covered activities that would result in temporary effects on natural communities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

NEPA Effects: The near-term loss of valley elderberry longhorn beetle habitat under Alternative 4 would not be adverse because the BDCP has committed to restoring and protecting an acreage that exceeds the typical mitigation ratios described above, in addition to avoiding impacts on shrubs and transplanting those that can't be avoided. In the absence of other conservation actions, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 4 in the late long-term would represent an adverse effect. However, with habitat protection and restoration associated with CM7, guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the BDCP permit term, the effects of Alternative 4 as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 4 would result in permanent and temporary impacts on 1,042 acres of modeled habitat (518 acres of riparian and 524 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres of riparian and 288 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). Based on the DHCCP survey data of the Conveyance Planning Area, an estimated 14 elderberry shrubs would be impacted in the near-term (see Section 12.3.2.3, *Methods Used to Assess Species Effects*, for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for valley elderberry longhorn beetle in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 61 acres of the riparian habitat should be restored/created and 61 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby minimizing adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS (1999) conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. CM7 specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS (1999) conservation guidelines.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs, are more than sufficient to support the conclusion that the near-term impacts of Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 1,557 acres of modeled valley elderberry longhorn beetle habitat (850 acres of riparian habitat and 707 acres of nonriparian habitat)during the BDCP permit term (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to protect 750 acres of riparian habitat and restore or create 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. The BDCP also includes a number of AMMs (AMM1–AMM6, AMM10, and AMM15) directed at minimizing or avoiding potential impacts on valley elderberry longhorn beetle. The large acreages of conservation would adequately compensate for the modeled habitats lost to construction and restoration activities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*,) estimates that the restoration and protection actions discussed above, as well as others actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 4 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic post-construction disturbances with localized impacts on valley elderberry longhorn beetle over the term of the BDCP. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis (see Section 12.3.2.3, *Methods Used to Assess Species Effects*, for a discussion on the methods used to make this estimate) estimates that approximately 37 shrubs could be indirectly affected by conveyance facilities construction (CM1). Restoration activities could result in excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15, which would be in effect throughout the BDCP permit term.

NEPA Effects: The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 4 conservation actions would not have an adverse effect on valley elderberry longhorn beetle.

CEQA Conclusion: Ground-disturbing activities, stockpiling of soils, and the potential release of dust and hazardous substances would accompany construction of the water conveyance facilities. An estimated 37 shrubs could be indirectly affected by conveyance facilities construction (CM1). In addition, ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks could indirectly affected elderberry shrubs that occur within 100 feet of these restoration activities. With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 4 construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse indirect effects on valley elderberry longhorn beetle in that the Plan would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 161 to 325 acres of modeled valley elderberry longhorn beetle habitat (Table 12-4-14).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 553 acres of modeled valley elderberry longhorn beetle habitat (Table 12-4-14).

It is unknown at this time how much of the modeled habitat that would be inundated as a result of CM2 and CM5 actually contains elderberry shrubs. Elderberry shrubs have been found to be intolerant of long periods of inundation and there is evidence that they die very quickly after even short periods of flooding (River Partners 2008). During monitoring of a restoration project at the San Joaquin River National Wildlife Refuge, River Partners found that nearly all (99 to 100%) of the four year old elderberry shrubs in restoration plots died after 15–17 weeks of inundation, and River Partners noted in general that the shrubs died very quickly after even short periods of flooding (River Partners 2008). Talley et al (2006) in their report assisting the USFWS 5-year review of the species, note that elderberry shrubs respond negatively to saturated soil conditions and that they can only tolerate temporary root crown inundation. Therefore, in the areas that would be periodically inundated by the implementation of CM2 it is likely that there are few, if any, mature shrubs in these areas because under current conditions they would be inundated in about 50% of all years for approximately 7 weeks. The areas affected by CM5 are not currently inundated and thus elderberry shrubs could be present in these areas.

The periodic effects on modeled habitat for valley elderberry longhorn beetle associated with implementing Alternative 4 could adversely affect valley elderberry longhorn beetle habitat (elderberry shrubs) and make modeled habitat there unsuitable for future elderberry establishment. Based on the information presented above, the current conditions in those areas that would be periodically inundated in Yolo Bypass (CM2) are not likely very suitable for elderberry shrubs and, thus, CM2 would likely have minimal effects, if any, on the species. The modeled habitat that would be periodically inundated from the implementation of CM5 could result in adverse effects on valley elderberry longhorn beetle.

NEPA Effects: Periodic effects of the inundation of valley elderberry longhorn beetle habitat as a result of implementing Alternative 4 conservation actions would not be adverse under NEPA when taking into consideration CM7 habitat protection and restoration. This habitat protection and restoration would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the time period that periodic effects would occur.

CEQA Conclusion: Alternative 4 (CM2 and CM5) would have periodic impacts on modeled valley elderberry longhorn beetle habitat. The periodic inundation of between 161 and 325 acres (CM2) and 553 acres (CM5) of modeled habitat could result in the death of elderberry shrubs that may occur there and thus potentially impact valley elderberry longhorn beetle. The Plan includes the restoration of 5,000 acres of riparian habitat (Objective VFRNC1.1) and the protection of 750 acres riparian habitat (VFRNC1.2) would include areas for elderberry restoration and protection. The BDCP also includes AMM1–AMM6, AMM10, and AMM15, which would minimize and avoid impacts on valley elderberry longhorn beetle prior to Yolo Bypass fisheries enhancement and floodplain restoration activities. AMM15, which includes a measure for following the USFWS (1999) conservation guidelines for valley elderberry longhorn beetle, would be used to identify shrubs for transplanting to conservation areas that otherwise could be adversely affected by periodic inundation in Yolo Bypass and floodplain restoration areas. These conservation actions would compensate for the periodic impacts on valley elderberry longhorn beetle.

Considering these protection and restoration provisions and avoidance and minimization measures, implementation of Alternative 4 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, periodic effects of inundation resulting from Alternative 4 would have a less-than-significant impact on valley elderberry longhorn beetle.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on nonlisted vernal pool invertebrates that are not covered by the Plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but do not include topographic depressions that are characteristic of vernal pools.

Construction and restoration associated with Alternative 4 conservation measures would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-4-15 and indirect conversions of vernal pool habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP that would benefit nonlisted vernal pool invertebrates (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (ObjectiveVPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (ObjectiveVPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)

- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)

As explained below, with the restoration or protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would not be adverse for NEPA purposes and would be less-than significant for CEQA purposes.

Table 12-4-15. Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1[g]	High-value (vernal pool complex)	13	13	1	1	NA	NA
	Low-value (degraded vernal pool complex)	7	7	2	2	NA	NA
Total Impacts CM1		**20**	**20**	**3**	**3**	**NA**	**NA**
CM2–CM18[g]	High-value (vernal pool complex)	0	0	0	0	0–4	0
	Low-value (degraded vernal pool complex)	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**221**	**392**	**3**	**3**	**0–4**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 4 conservation measures would result in the direct, permanent loss of up to 392 acres of vernal pool habitat from conveyance facilities construction (CM1) and the hypothetical footprints for tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic alteration of an additional 177 acres of vernal pool habitat (132 acres of high-value habitat and 45 acres of low-value habitat) from conveyance facilities construction (CM1) and based on the hypothetical footprints for tidal restoration (CM4). Construction of the water conveyance facilities and restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute an indirect effect unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the vernal pools. As specified in the BDCP, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pools are permanently lost. *AMM12 Vernal Pool Crustaceans* would ensure that no more than 20 wetted acres of vernal pool habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent and temporary combined loss of approximately 23 acres of vernal pool habitat, composed of 14 acres of high-value and 9 acres of low-value habitat (Table 12-4-15). In addition, the conveyance facilities could result in the indirect conversion of 42 acres of vernal pool habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, storage of reusable tunnel material, and construction of permanent access roads. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that temporary transmission lines are designed to avoid removal wetted acres of aquatic habitats to the maximum extent practicable. There are no records of these nonlisted vernal pool invertebrates at this location (California Department of Fish and Game 2012).
- *CM4 Tidal Natural Communities Restoration:* Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown but a 2012 review of Google Earth imagery of these habitats found that they appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool species as evidenced

by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Game 2012). So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool invertebrates and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool invertebrate habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool habitat, which consist of 90 acres of high-value and 45 acres of low-value habitat. No records of nonlisted vernal pool invertebrates would be directly impacted.

- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool invertebrates. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-4-16 was prepared to further analyze BDCP effects on nonlisted vernal pool invertebrates using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, and AMM12, which are measured in wetted acres of habitat. Wetted acres were estimated by using the BDCP's assumption that vernal pool complexes and degraded vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4-16. Estimated Effects on Wetted Nonlisted Vernal Pool Species Habitat under Alternative 4 (acres)

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 4 Impact[b]	CM1	3.5	3.5	6.3	6.3
	CM4[c]	30.2	55.8	11.0	20.3
Total		**33.7**	**59.3**	**17.3**	**26.6**

[a] Because roughly half of the impacts would occur in the near-term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-4-15 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4-15 above lists the impacts on nonlisted vernal pool invertebrate habitat that are based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools (see AMM12 and AMM30). As seen in Table 12-4-16, the effects of CM1 alone would be well within the near-term limits. As seen in Table 12-4-16, Alternative 4 would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 3.5 wetted acres of vernal pool (or 23 acres of vernal pool complex) should be restored and 19.6 wetted acres (or 131 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on nonlisted vernal pool species habitat. However, with the implementation of AMM30, the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay. Assuming that the BDCP would apply the impact limits presented in Table 12-4-13 and implement AMM30, direct impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to not exceed 1.5 acres of direct effects on wetted vernal pool crustacean habitat (5 acre limit minus the 3.5 acres from CM1) and indirect impacts could not exceed 3.7 wetted acres. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5.1 wetted acres (34 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The Plan's biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrate habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, although developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-4-16, the effects of CM1 alone would be within the near-term limits, but overall Alternative 4 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

NEPA Effects: The near-term loss of vernal pool habitat under Alternative 4 would not be adverse under NEPA because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, he potential modification of vernal pool habitat and potential mortality of special-status species resulting from Alternative 4 in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the time BDCP permit term. Considering these commitments, losses and conversions of nonlisted vernal pool invertebrates habitat under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Table 12-4-15 above lists the impacts on vernal pool habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools (see AMM12 and AMM30). As seen in Table 12-4-16, the effects of CM1 alone would be within the near-term limits. As seen in Table 12-4-16, Alternative 4 would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 3.5 wetted acres of vernal pool (or 23 acres of vernal pool complex) should be restored and 19.6 wetted acres (or 131 acres of vernal pool complex) protected to mitigate the CM1 direct and indirect effects on nonlisted vernal pool species habitat. However, with the implementation of AMM30, the aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay. Assuming that the BDCP would apply the impact limits presented in Table 12-4-13 and implement AMM30, impacts on wetted vernal pools resulting from tidal restoration in the near-term would have to not exceed 1.5 acres of direct effects on wetted vernal pool crustacean habitat (5 acre limit minus the 3.5 acres from CM1) and indirect impacts could not exceed 3.7 wetted acres. The impacts based on the hypothetical tidal restoration footprints would exceed these limits. When and if these limits are met, the BDCP would need to restore up to 5.1 wetted acres (34 acres of vernal pool complex) and protect up to 30 wetted acres (200 acres of vernal pool complex) in the near-term to offset the effects of CM1 and CM4.

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrates.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities, AMM30 Transmission Line Design,* and *Alignment Guidelines,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, although developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-4-16, the impacts of CM1 alone would be within the near-term limits, but overall Alternative 4 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

The effects on nonlisted vernal pool invertebrate habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the BDCP permit term. Considering these commitments, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 4 would have a less-than-significant impact on nonlisted vernal pool invertebrates.

Impact BIO-39: Indirect Effects of Plan Implementation on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the BDCP permit term.

***NEPA Effects*:** Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the BDCP permit term. Nonlisted vernal pool invertebrates and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebays could result in the inadvertent discharge of sediments and hazardous materials into vernal pool habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the BDCP permit term. The indirect effects of plan implementation under Alternative 4 would not be adverse.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout BDCP permit term. The indirect impacts of Alternative 4 would be less than significant.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass under *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled habitat for nonlisted vernal pool invertebrates (Table 12-4-15). There would be no periodic effects from *CM5 Seasonally Inundated Floodplain Restoration*

***NEPA Effects*:** BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect nonlisted vernal pool invertebrates occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus not be adverse.

CEQA Conclusion: Alternative 4 would periodically inundate at most 4 acres of nonlisted vernal pool invertebrates' habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of nonlisted vernal pool invertebrates' habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus result in less-than-significant impacts on the species.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes the inland dune scrub at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 4 would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance construction would not affect inland dune scrub habitat at Antioch Dunes NWR. No dredge spoil areas that could be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 4 water intake facilities on aerial imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of BDCP restoration based conservation measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the Plan Area is at Antioch Dunes, which would not be impacted by the Alternative 4 conservation measures. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of BDCP restoration actions, and other covered activities could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the Plan Area; however the extent of these habitats in the Plan Area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Over the term of the BDCP, Alternative 4 would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 4 objectives would generally increase opportunities for the formation of sandbars in the Plan Area.

- Restore 10,000 acres of seasonally inundated floodplain (Objective L2.11, associated with CM5).
- Enhance 20 miles of channel margin habitat (Objective L2.12, associated with CM6).
- Restore 5,000 acres of riparian habitat, with at least 3,000 acres occurring on restored seasonally inundated floodplain. (VFRNC1.1, associated with CM7).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins and in floodplains, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins and floodplains would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-17. Changes in Sacramento and Antioch Dunes Anthicid Beetles' Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	UNK	UNK	UNK	UNK	0	UNK
Total Impacts CM2–CM18	**UNK**	**UNK**	**UNK**	**UNK**	**0**	**UNK**
TOTAL IMPACTS	**UNK**	**UNK**	**UNK**	**INK**	**0**	**UNK**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable
UNK = unknown

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 4 conservation measures could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur along to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of Google Earth imagery in the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery in the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Conservation measures that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal habitat restoration (CM4), floodplain restoration (CM5), and channel margin enhancement (CM6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The West Delta ROA has been identified in the BDCP (BDCP Chapter 3, Section 3.4.4, *Conservation Measure 4*,) as providing opportunities for creating subtidal aquatic and tidal marsh habitats. The methods and techniques identified in BDCP Chapter 3, Section 3.4.4.3.3, *Methods and Techniques*, that may be used for tidal restoration include the recontouring of lands so that they have elevations suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.

- *CM5 Seasonally Inundated Floodplain Restoration*: Seasonally inundated floodplain restoration could impact areas with sandbars that were identified in a review of aerial photographs. The sandbars identified along the San Joaquin River and Paradise Cut are within the conceptual corridors (Corridors 1a, 1b, 2a, and 4) identified in Figure 3.4-20 of the BDCP. There are four CNDDB records for Sacramento anthicid beetle in the conceptual corridor along the San Joaquin River (California Department of Fish and Wildlife 2013). Floodplain restoration actions in these conceptual corridors could impact potential habitat for both these species and occupied habitat of Sacramento anthicid beetle.

- *CM6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 20 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 4 could result in substantial affects on Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which is being considered for tidal restoration (CM4), or within three of the conceptual corridors being considered for floodplain restoration (CM5). Furthermore, all seven of the records for Sacramento anthicid beetle within the study area fall within areas being considered for restoration (CM4 and CM5), which represent over half of the extant records for this species range wide (7 of 13), and the only extant record for Antioch Dunes anthicid beetle, which represent one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected by restoration if these areas are chosen as restoration projects. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. Under Alternative 4, CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. These measures would improve shoreline conditions by creating benches along levees (CM6), creating shallow margin and floodplain habitat (CM5), and increasing shoreline vegetation (CM7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form. Other factors relevant to effects on Sacramento and Antioch Dunes anthicid beetles are listed below.

- The actual extent of suitable and occupied habitat for these species in the plan is unknown.
- The sandbar habitat occupied by Sacramento anthicid beetle along the San Joaquin River would likely not be directly impacted where floodplain restoration occurs because the physical disturbance would be to adjacent levees and agricultural areas. Though these actions would change hydrologic conditions that could overtime remove the existing sandbars, the expanded floodplain would create conditions suitable for the formation of new and possibly larger sandbars.
- Floodplain restoration would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

NEPA Effects**:** The potential impacts on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 4 as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with implementation of restoration associated with CM5, CM6, and CM7, which would be phased throughout the time period when the impacts would be occurring, the effects of Alternative 4 as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion**:** Alternative 4 would impact Sacramento and Antioch Dunes anthicid beetles' habitat and could impact seven occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. BDCP conservation components, particularly conservation measures CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. Floodplain restoration (CM5) would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

Considering that floodplain (CM5), channel margin enhancement (CM6), and riparian restoration (CM7) would contribute to the replacement of and possible expansion of sandbar habitat in the Delta and be phased throughout the time period when the impacts would be occurring, the implementation of Alternative 4 as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than-significant impact on Sacramento and Antioch Dunes anthicid beetles.

Delta Green Ground Beetle

Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4 would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 4 could affect delta green ground beetle through the protection of grasslands and vernal pool complex (CM3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions and recreational trail construction (CM11) in these areas. In addition, tidal natural communities restoration (CM4) and vernal pool and alkali seasonal wetland complex restoration (CM9) could result in potential impacts on delta green ground beetle and its habitat. Full implementation of Alternative 4 would likely result in beneficial effects on delta green ground beetle through the following conservation actions.

- Protect 2,000 acres of grassland in CZ 1 (Objective GNC1.1, associated with CM3).
- Protect 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1, associated with CM3).
- Restore up to 67 acres of vernal pool complex in CZs 1, 8, and/or 11 (Objective VPNC1.2, associated with CM9).

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4-18. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 4 conservation measures could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Conservation measures that could affect delta green ground beetle include tidal natural communities habitat restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and habitat enhancement and management activities (CM11) in CZ 1. CZ 1 is the only portion of the Plan Area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; USFWS 2009). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *CM4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. CM4 identifies 5,000 acres of freshwater tidal natural communities restoration in the Cache Slough ROA, and Lindsey Slough and Calhoun Cut have been identified as areas suitable for restoration. Lindsey Slough is just east of Jepson Prairie, and Calhoun Cut, which is off of Lindsey Slough (see Figure 12-1), goes into the general Jepson Prairie area and is adjacent to areas of potential habitat for delta green ground beetle. The tidal restoration methods and techniques identified in CM4 (see BDCP Chapter 3, Section 3.4.4.3.3, *Methods and Techniques*) includes excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affect delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species. No CNDDB records for delta green ground beetle are intersected by the hypothetical tidal restoration footprints being used by the BDCP.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle. However, if these activities do take place in suitable habitat, then disturbances could result in direct mortality of the species. Nevertheless, restoration ultimately would expand habitat available to the species.

- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 1 and a portion of the 600 acres of protection and possibly some of the up to 10 wetted acres of vernal pool restoration could also occur in CZ 1. Potential effects from CM11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of CM11 would result in impacts on 15.5 acres of grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The protection of 2,000 acres of grassland in CZ 1 (CM3) and the protection of 600 acres of vernal pool complex and up 10 wetted acres of vernal pool complex restoration, some of which could occur in CZ 1 (CM3 and CM9) could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. The management of these grasslands and vernal pool complexes according to *CM11 Natural Communities Enhancement and Management* and the construction of recreational trails in CZ 1 has a potential to affect this species. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Direct mortality and/or the affects to delta green ground beetle habitat would be an adverse effect under NEPA. Implementation of mitigation measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce this effect.

CEQA Conclusion: The implementation of grassland and vernal pool complex protection (CM3), tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from CM11 could include direct mortality to larvae and adults resulting from the implementation of recreation trail construction in 15.5 acres of grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and therefore result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce these potential impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areas in the area of Jepson Prairie, BDCP proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.

- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing covered activities in these areas will be avoided, which for the Plan Area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing covered activities will occur in areas identified as occupied by delta green ground beetle.
- Based on the results of the habitat evaluations and surveys, site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

This section describes the effects of Alternative 4 on callippe silverspot butterfly. Suitable habitats are typically in areas influenced by coastal fog with hilltops that support the specie's host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldenaster, coast buckwheat, mourning bride, and California buckeye. Suitable habitat in the Plan Area is located in CZ11 in the Cordellia Hills west of I-680 and in the Potrero Hills on the northern edge of Suisun Marsh. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4 would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *CM3 Natural Communities Protection and Restoration* and the subsequent implementation of *CM11 Natural Communities Enhancement and Management,* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the Plan Area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Though CZ 11 has been identified as potential area for grassland restoration in *CM8 Grassland Natural Community Restoration,* the primary goal there is to restore small patches of grassland to connect to Jepson Prairie and/or the restoration of upland grasses adjacent to tidal brackish emergent wetland in Suisun Marsh, both of which would not be areas suitable for callippe silverspot butterfly. The full implementation of Alternative 4 would protect up to 2,000 acres of grassland in CZ 11 (Objective GNC1.1, associated with CM3), some of which may contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4-19. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 4 conservation measures could result in the conversion of habitat and/or direct mortality to callippe silverspot butterfly. Only one conservation measure was identified as potentially affecting Callippe silverspot butterfly, *CM11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *CM3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of 2,000 acres of grassland within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. However, the management of these grasslands according to *CM11 Natural Communities Enhancement and Management* also has a potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *CM3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has a potential to affect this species. Potential impacts from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults resulting from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, which could result in direct and indirect effects on larval host plants and nectar plants. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would therefore result in significant impact on the species under CEQA. However, over the term of BDCP callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and thus reduce the potential impact to a less-than-significant level.

Mitigation Measures BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, BDCP proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.

- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-4-20. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11. Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP to benefit the California red-legged frog (see BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11, CM13, and CM20).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3)
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-20. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	1	1	0	0	NA	NA
	Upland	21	21	32	32	NA	NA
Total Impacts CM1		**21**	**21**	**32**	**32**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	8	24	0	0	0	0
Total Impacts CM2–CM18		**8**	**24**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**29**	**45**	**32**	**32**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 4 conservation measures would result in the permanent and temporary loss combined of up to 1 acre of modeled aquatic habitat and 77 acres of modeled upland habitat for California red-legged frog (Table 12-4-20). Conservation measures that would result in these losses are conveyance facilities and transmission line construction (CM1) and recreational facility construction for CM11. Construction activities associated with the water conveyance facilities and recreational facilities, including operation of construction equipment, could result in temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4, including transmission line construction, would result in the permanent loss of up to 1 acre of aquatic habitat and 21 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-4-20). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California red-legged frog (Table 12-4-20). Although there are no California red-legged frog occurrences that overlap with the CM1 construction footprint there are a number of occurrences to the west of Clifton Court Forebay.

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 4, *Covered Activities and Associated Federal Actions*, an estimated 24 acres of upland cover and dispersal habitat for the California red-legged frog would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California red-legged frog are expected to be minimal.

  Activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs discussed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog.

- Critical habitat: Several conservation measures would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Conservation actions to protect and enhance grassland habitat for covered species, including California red-legged frog, in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation conservation actions and AMM1–AMM6, AMM10, AMM14, and AMM37, would reduce these effects.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA

Alternative 4 would result in permanent and temporary effects combined on approximately 1 acre of aquatic habitat and 61 acres of upland habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 53 acres) and recreational facilities (CM11, 8 acres).

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California red-legged frog in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 122 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM14 California Red-Legged Frog, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic habitat and 7,766 acres of upland habitat for California red-legged frog. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 77 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and approximately 1% of the total upland habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

NEPA Effects: In the near-term, the loss of California red-legged frog habitat under Alternative 4 would be not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 4, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 4 as a whole on California red-legged frog would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impact of conveyance facilities construction would be less than significant under CEQA.

Alternative 4 would result in permanent and temporary effects combined on approximately 1 acre of aquatic habitat and 61 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of the water conveyance facilities (CM1, 53 acres and CM11, 8 acres).

Typical CEQA project-level mitigation ratios of 1:1 for restored and 1:1 protected for nontidal wetlands and a ratio of 2:1 for protected grassland habitats would indicate that 1 acre of aquatic habitat should be protected, 1 acre of aquatic habitat should be protected, and 122 acres of grassland should be protected in for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, will benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands will be protected to provide aquatic habitat for this species, and surrounding grassland will provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5 in Chapter 3, *Conservation Strategy*, of the BDCP).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM14, and AMM37. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 on California red-legged frog would be less than significant, because the number of acres required to meet the typical ratios described above would be only 1 acre of aquatic habitat restored, 1 acre of aquatic habitat protected, and 106 acres of upland communities protected.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic habitat and 7,766 acres of upland habitat for California red-legged frog. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 77 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total aquatic habitat in the study area and approximately 1% of the total habitat in the study area). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of up to 8,000 acres grassland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros

Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

In the absence of other conservation actions, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 4 would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 4 would have a less-than-significant impact on California red-legged frog.

Impact BIO-45: Indirect Effects of Plan Implementation on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted by DWR in this area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 4 would avoid the potential for adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on California red-legged frog.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance, as well as construction-related noise and visual disturbances including aritifical nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, Alternative 4 construction, operation, and maintenance under Alternative 4 would avoid the potential for significant impacts on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 4 would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

California tiger salamander occurs within the study area in CZ 8 west of Clifton Court Forebay and in CZ 11 in the Potrero Hills (Figure 12-14). Potential habitat exists in vernal pool habitats in Yolo and Solano Counties (CZs 1, 2, and 3) west of Liberty Island and in the vicinity of Stone Lakes and the Cosumnes River Preserve in Sacramento County (CZ 4). DWR found California tiger salamander west of Clifton Court Forebay in the same vicinity as several of the CNNDB records (California Department of Fish and Wildlife 2013) (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). There is also a small, isolated population near Manteca, south of Highway 120 in CZ 7.

Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While conservation measures implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 4 is expected to result in the temporary, permanent, and periodic removal of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-4-21). Potential aquatic habitat for this species would not be affected. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP to benefit the California tiger salamander (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Protect 600 acres of existing vernal pool complex in in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).
- Increase the size and connectivity of protected vernal pool complex within the Plan Area and increase connectivity with protected vernal pool complex adjacent to the Plan Area (Objective VPNC1.3, associated with CM3).
- Protect the range of inundation characteristics that are currently represented by vernal pools throughout the Plan Area (Objective VPNC1.4, associated with CM3).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-21. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	0	0	0	0	NA	NA
	Upland	19	19	32	32	NA	NA
Total Impacts CM1		**19**	**19**	**32**	**32**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	292	634	0	0	191–639	0
Total Impacts CM2–CM18		**292**	**634**	**0**	**0**	**191–639**	**0**
TOTAL IMPACTS		**311**	**653**	**32**	**32**	**191–639**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 4 conservation measures would result in the permanent and temporary loss combined of up to 685 acres of modeled upland habitat for California tiger salamander (Table 12-4-21). There would be no effects on aquatic habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), construction of recreation facilities (CM11), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California tiger salamander habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities, including transmission lines, would result in the permanent loss of 19 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-4-21). Permanent effects would be associated with RTM, borrow, and spoils areas, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California tiger salamander (Table 12-4-21). There is one California tiger salamander occurrence just south of the City of Byron that overlaps with the area of temporary effects. The area that would be affected by conveyance facilities construction is south of Clifton Court Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent removal of approximately 42 acres of terrestrial cover and aestivation habitat for the California tiger salamander in the late long-term. The modeled habitat in the Yolo Bypass is of low potential for California tiger salamander: There have been no observations of California tiger salamander in this area based on the results of a number of surveys for vernal pool invertebrates and plants and the bypass lacks vernal pool complexes with large, deep pools or large grassland areas with stock ponds and similar aquatic features that hold water long enough to provide potential breeding habitat for this species.
- *CM4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of approximately 517 acres of terrestrial cover and aestivation habitat in the study area in the late long-term. Tidal restoration in the Cache Slough area would result in habitat loss along the edges of Lindsey Slough and Duck Slough, and adjacent to cultivated land along the eastern edge of a block of modeled habitat. The modeled aquatic breeding habitat nearby the hypothetical tidal restoration footprint is of relatively high value, consisting of vernal pool complex along Lindsey Slough within the Jepson Prairie area in and near open space. The Jepson Prairie area includes numerous California tiger salamander CNDDB recorded occurrences and overlaps with Critical Habitat Unit 2, Jepson Prairie Unit, for this species. However, the hypothetical tidal restoration footprint does not overlap with critical habitat or recorded occurrences in this area. The tidal restoration at Lindsey Slough would occur along the northeastern edge of the Jepson Prairie block of habitat and would not contribute to fragmentation. Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because of the ability to select sites that minimize effects on California tiger salamander.
- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 4, *Covered Activities and Associated Federal Actions*, an estimated 40 acres of terrestrial cover and aestivation habitat for the California tiger salamander would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California tiger salamander are expected to be minimal.

Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values over the term of the BDCP. Activities associated with natural communities enhancement and management over the term of the BDCP in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- *CM18 Conservation Hatcheries*: This activity could result in the permanent removal of approximately 35 acres of terrestrial cover and aestivation habitat for California tiger salamander in the Yolo Bypass area (CZ 2). The specifications and operations of this facility have not been developed, although the facility is expected to be constructed near Rio Vista on cultivated lands in low-value habitat for the species.
- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions. Tidal habitat would be restored approximately 2 miles east of SR 113, with some restoration taking place along the Barker and Lindsey Slough channels west to approximately SR 113 and a small amount (0.4 acre) taking place along the Lindsey Slough Channel west of SR 113 into Critical Habitat Unit 2.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.
- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 4 would permanently remove and temporarily affect approximately 343 acres of upland terrestrial cover habitat for California tiger salamander. There would be no effects on aquatic habitat. The effects would result from construction of the water conveyance facilities (CM1, 51 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

Typical NEPA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 686 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes.

In addition, the plan contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander. Alternative 4 as a whole would result in the permanent loss of, and temporary effects on, 685 acres of upland habitat for California tiger salamander for the term of the plan (approximately 2% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres of grassland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

NEPA Effects: In the near-term, the loss of California tiger salamander habitat under Alternative 4 would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California tiger salamander upland habitat associated with Alternative 4, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, the effects of Alternative 4 as a whole on California tiger salamander would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant under CEQA.

Alternative 4 would permanently and temporarily combined remove approximately 343 acres of upland terrestrial cover habitat for California tiger salamander. There would be no effects on aquatic habitat. The effects would result from construction of the water conveyance facilities (CM1, 51 acres), Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres) construction of conservation hatcheries (CM18, 35 acres), and construction of recreational facilities (CM11, 12 acres).

Typical CEQA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 686 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes.

In addition, the plan contains commitments to implement AMM1–6, AMM10, AMM13, and AMM37, which include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 4 on California tiger salamander would be less than significant, because the number of acres required to meet the typical ratios described above would be only 636 acres of upland communities protected.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland habitat for California tiger salamander. Alternative 4 as a whole would result in the permanent loss of, and temporary effects on, 685 acres of upland habitat for California tiger salamander for the term of the plan (approximately 2% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM1, CM2, CM4, and CM18.

Implementation of BDCP conservation components would result in protection of at least 8,000 acres of grasslands, 600 acres of vernal pool complex and 150 acres of alkali seasonal wetland complex in CZ 1, CZ 8, and CZ 11, and restoration of 2,000 acres of grasslands and 67 acres of vernal pool complex, all of which would benefit California tiger salamander. The protection and restoration would provide habitat in the portions of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas. Ponds and other aquatic features in the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat. Protected grassland and vernal pool complex in CZ 8 would connect with the East Contra Costa County HCP/NCCP reserve system, including grassland areas supporting this species. Protected lands in CZ 11 would connect with the future Solano County reserve system, including grassland and vernal pool complex areas supporting this species. The larger habitat area and improved connectivity would increase opportunities for genetic exchange and allow for colonization of restored habitats in areas where the species has been extirpated. Protecting seasonal ponds associated with grasslands would ensure that California tiger salamander aquatic habitat and associated uplands would be preserved and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area. Grassland restoration would focus specifically on connecting fragmented patches of protected grasslands, thereby increasing dispersal opportunities for the California tiger salamander. Grasslands would be enhanced to increase burrow availability to provide refugia and cover for aestivating and dispersing California tiger salamanders.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat. In the absence of other conservation actions, the losses of California tiger salamander upland habitat associated with Alternative 4 would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction phase, the impacts of Alternative 4 as a whole on California tiger salamander would not be significant.

Impact BIO-47: Indirect Effects of Plan Implementation on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conservation component construction and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical night lighting at a worksite over the term of the BDCP. Most of the areas indirectly affected are associated with the construction of Byron Forebay and its borrow and spoil areas in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 4 would avoid or minimize the potential for adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances, including aritifical night lighting at a worksite could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 4, the BDCP would avoid the potential for significant impacts on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders.

The indirect effects of Alternative 4 would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement is the only conservation measure expected to result in periodic inundation of California tiger salamander habitat. Periodic inundation of Yolo Bypass could affect from an estimated 191 acres of terrestrial habitat during a notch flow of 1,000 cfs, to an estimated 639 acres of terrestrial habitat during a notch flow of 4,000 cfs in CZ 1 (Table 12-4-21). This effect would only occur during an estimated maximum of 30% of years and in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal terrestrial habitat for the California tiger salamander under Existing Conditions. No aquatic breeding habitat would be affected (Table 12-4-21): the modeled habitat in the Yolo Bypass, in the vicinity of terrestrial habitat is of low value in that there are no California tiger salamander records in this area and the bypass lacks vernal pool complexes with large, deep pools, or large grassland areas with stock ponds and similar aquatic features that provide the habitat of highest value for this species. Therefore, the terrestrial habitat that would be affected has a small likelihood of supporting California tiger salamanders, and Yolo Bypass operations are expected to have a minimal effect on the species, if any.

***NEPA Effects*:** The effects of periodic inundation from Alternative 4 would not have an adverse effect on California tiger salamander.

***CEQA Conclusion*:** Flooding of the Yolo Bypass from Fremont Weir operations would periodically increase the frequency and duration of inundation of 191–639 acres of terrestrial habitat for California tiger salamander. Because this area is considered low-value habitat and there are no California tiger salamander records in the area, and because of the lack of suitable breeding habitat in this area, the effects of periodic inundation of California tiger salamander habitat from Alternative 4 would have a less-than-significant impact**.**

Giant Garter Snake

The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic (except in Suisun Marsh), tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-4-22. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP to benefit the giant garter snake (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3 and CM11).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Of the at least 1,200 acres of nontidal marsh created under (Objective NFEW/NPANC1.1), create 600 acres of aquatic habitat giant garter snake aquatic habitat that is connected to the 1,500 acres of rice land or equivalent-value habitat described below in Objective GGS1.4 (Objective GGS1.1, associated with CM3, CM4, and CM10).
- Of the 8,000 acres of grassland protected under Objective GNC1.1 and 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of nontidal perennial habitat being restored and/or created in CZ 4 and/or CZ 5 (Objective GGS1.2, associated with CM3 and CM8).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands (Objectives GGS1.1 and GGS1.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS1.3, associated with CM3).
- Create connections from the White Slough population to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting, restoring, and/or creating at least

1,500 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 1,500 acres may consist of tidal freshwater emergent wetland and may overlap with the 24,000 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria described in CM4. Up to 500 (33%) of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS1.4, associated with CM3 and CM4).

- Of the at least 1,200 acres of nontidal marsh created under Objective NFEW/NPANC1.1, create 600 acres of connected aquatic giant garter snake habitat outside the Yolo Bypass in CZ 2 (Objective GGS2.1, associated with CM3 and CM10).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland habitat adjacent to the 600 acres of nontidal marsh created in CZ 2 outside of Yolo Bypass (GGS2.1) (Objective GGS2.2, associated with CM3 and CM8).
- To expand upon and buffer the newly restored/created nontidal perennial habitat in CZ 2, protect 700 acres of cultivated lands, with 500 acres consisting of rice land and the remainder consisting of compatible cultivated land that can support giant garter snakes. The cultivated lands may be a subset of lands protected for the cultivated lands natural community and other covered species (Objective GGS2.3, associated with CM3).
- Protect giant garter snakes on created nontidal marsh (Objective GGS2.1) and created or protected adjacent uplands (Objective GGS2.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads, and establishing giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS2.4, associated with CM3).
- Protect, restore, and/or create 2,740 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 1, CZ 2, CZ 4, or CZ 5. Up to 500 acres may consist of tidal freshwater emergent wetland and may overlap with the at least 5,000 acres of tidally restored freshwater emergent wetland in the Cache Slough ROA if this portion meets giant garter snake habitat criteria specified in CM4. Up to 1,700 acres may consist of rice fields in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*. Any remaining acreage will consist of rice land or equivalent-value habitat outside the Yolo Bypass. Up to 915 (33%) of the 2,740 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS3.1, associated with CM3, CM4, and CM10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-22. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 4[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Aquatic (acres)	210	210	110	110	NA	NA
	Upland (acres)	408	408	206	206	NA	NA
	Aquatic (miles)	11	11	6	6	NA	NA
Total Impacts CM1 (acres)		**618**	**618**	**316**	**316**	**NA**	**NA**
CM2–CM18	Aquatic (acres)	179	498	15	38	NA	NA
	Upland (acres)	1,467	2,443	219	261	582–1,402	606
	Aquatic (miles)	49	189	9	10	NA	NA
Total Impacts CM2–CM18 (acres)		**1,646**	**2,941**	**234**	**299**	**582–1,402**	**606**
TOTAL IMPACTS CM1–CM18 (acres)		**2,264**	**3,559**	**550**	**615**	**582–1,402**	**606**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.
[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts on upland habitats only are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 4 conservation measures would result in the permanent and temporary loss combined of up to 856 acres of modeled aquatic habitat (tidal and nontidal combined), up to 3,381 acres of modeled upland habitat, and up to 216 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-4-22). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, geotechnical investigation, and establishment and use of RTM, borrow, and spoils areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent loss of approximately 618 acres of modeled giant garter snake habitat, composed of 210 acres of aquatic habitat and 408 acres of upland habitat (Table 12-4-22). The 408 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 116 acres of high-, 262 acres of moderate-, and 30 acres of low-value habitat. In addition, approximately 11 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 110 acres of giant garter snake aquatic habitat and up to 206 acres of adjacent upland habitat in areas near construction and geotechnical investigation in CZ 5 and CZ 6 (see Table 12-4-22 and the Terrestrial Biology Mapbook). In addition, approximately 6 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction. There are three giant garter snake occurrences in the vicinity of the CM1 construction footprint in Snodgrass Slough and Middle River.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 83 acres of aquatic habitat and 458 acres of upland habitat for the giant garter snake in the late long-term. The upland habitat that would be removed is composed of 336 acres of high-value, 121 acres of moderate-value, and 1 acre of low-value habitat. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Most of this habitat removal would occur at the north end of the Yolo Bypass, near Fremont Weir. Construction is expected to have adverse effects on giant garter snake aquatic habitat in the Yolo Bypass area because it is near the Yolo Basin/Willow Slough subpopulation.

  In addition to habitat loss from construction related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 395 acres of aquatic habitat and 2,123 acres of upland habitat for the giant garter snake to tidal marsh in the late long-term. The upland habitat affected by tidal inundation includes 594 acres of high-value, 1,375 acres of moderate-value, and 154 acres of low-value habitat. In addition, approximately 138 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration.

  Most of the effects of tidal natural communities restoration would occur in the Cache Slough and Yolo Bypass areas (CZ 1 and CZ 2). This aquatic habitat is of low to moderate value: it is in and near Category 1 open space but is not near any giant garter snake occurrences and is not near or between giant garter snake subpopulations identified in the draft recovery plan. Tidal natural communities restoration is expected to have little to no adverse effects on giant garter snake aquatic or upland habitat in the Cache Slough ROA. There are no giant garter snake occurrences in this area, which is already tidally influenced so it has limited value for the giant garter snake (giant garter snakes may occur in tidally muted areas but are not likely to use aquatic areas with a strong tidal influence).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 89 acres of upland habitat for giant garter snake. The upland habitat to be removed is composed of 51 acres of moderate-value and 38 acres of low-value upland habitat. Approximately 2 miles of channels providing giant garter snake movement habitat would be removed as a result of floodplain restoration. Seasonally inundated floodplain restoration is expected to have little to no adverse effects on giant garter snake aquatic habitat because the site is not located near or between giant garter snake populations identified in the draft recovery plan. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on giant garter snake habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal because vegetation removal would occur around existing infrastructure and roads where giant garter snake are not as likely to be present. Any of these minor impacts would be avoided and minimized by the AMMs listed below.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, AMM37 requires setbacks for trails in giant garter snake habitat (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). With this measure in place, recreation related effects on giant garter snake are expected to be minimal.

- *CM18 Conservation Hatcheries*: Construction for conservation hatcheries could result in the permanent removal of 35 acres of moderate-value upland habitat for the giant garter snake in the Yolo Bypass area (CZ 2).

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the two subpopulations: Yolo Basin/Willow Slough [CZ 2] and the Coldani Marsh/White Slough [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 4 would permanently and temporarily remove 514 acres of aquatic habitat and 2,300 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 320 acres of aquatic and 614 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 75 miles of channels (irrigation and drainage canals) providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 514 acres of aquatic habitat should be restored, 514 acres of aquatic habitat should be protected, and 4,600 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 514 acres of aquatic communities restored, 514 acres of aquatic communities protected, and 4,600 acres of upland communities protected.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities, AMM16 Giant Garter Snake, and AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 856 acres of aquatic habitat and to 3,318 acres of upland habitat for giant garter snake during the term of the plan (3% of the total aquatic habitat and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS3.1 would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). In addition to the 6,540 acres of high value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

NEPA Effects: In the near-term, the loss of giant garter snake habitat under Alternative 4 would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of giant garter snake habitat associated with Alternative 4, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM7, AMM10, AMM16, and AMM37, the effects of Alternative 4 as a whole on giant garter snake would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 4 would permanently and temporarily remove 514 acres of aquatic habitat and 2,300 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 320 acres of aquatic and 614 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 77 miles of channels (irrigation and drainage canals) providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 514 acres of aquatic habitat should be restored, 514 acres of aquatic habitat should be protected, and 4,600 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 514 acres of aquatic communities restored, 514 acres of aquatic communities protected, and 4,600 acres of upland communities protected.

The Plan also includes commitments to implement AMM1–AMM7, AMM10, AMM16, and AMM37. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 856 acres of aquatic habitat and to 3,318 acres of upland habitat for giant garter snake during the term of the plan (3% of the total aquatic habitat in the study area and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS3.1 would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (*CM3 and CM11*) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

The BDCP also includes AMM1–AMM7, AMM10, AMM16, and AMM37, which are directed at minimizing or avoiding potential impacts on adjacent habitats during construction and operation of the conservation measures. Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 4 as a whole would not result in a significant impact through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of giant garter snake habitat and potential mortality of snakes would have a less-than-significant impact on giant garter snake under CEQA.

Impact BIO-50: Indirect Effects of Plan Implementation on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect throughout the plan's construction phase.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under CM1 were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see Appendix 11F, *Substantive BDCP Revisions*).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and floodplains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with minimization and mitigation measures and adaptive management and monitoring, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is expected to reduce the amount of methylmercury resulting from the restoration of natural communities and floodplains.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the Central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Effects on giant garter snake from increased methylmercury exposures is more likely in the Yolo Basin, where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008). Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). Planned floodplain restoration activities in the Yolo Basin are expected to seasonally increase methylmercury production, although production would be minimized by *CM12 Methylmercury Mitigation*. Further, the periods of production and increased exposure to methylmercury do not overlap with giant garter snake seasonal activity periods. This seasonal trend should help to decrease risk to the giant garter snake, although snakes could prey on individuals that have been exposed to methylmercury during the previous season.

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *CM12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 is expected to reduce the effects of methylmercury resulting from BDCP natural communities and floodplain restoration on giant garter snake.

NEPA Effects: Implementation of the AMMs and *Environmental Commitment 12 Methylmercury Management* listed above as part of implementing Alternative 4 would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on giant garter snake.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37as part of Alternative 4 construction, operation and maintenance, the BDCP would avoid and minimize the potential for significant impacts on giant garter snakes, either indirectly or through habitat modifications. Therefore, the indirect effects of Alternative 4 would have a less-than-significant impact on giant garter snakes.

Giant garter snake could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes, and, therefore, would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 4 would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

NEPA Effects: Alternative 4 would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

CEQA Conclusion: Alternative 4 would have a less-than-significant impact on connectivity among giant garter snakes in the study area and therefore no mitigation is required.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement: The proposed changes in Fremont Weir operations would occur intermittently from as early as mid-November through as late as mid-May. The core operations would occur during the winter/spring period, which corresponds mostly with the giant garter snake's inactive season. During this time, snakes are overwintering underground. Giant garter snakes that occur in the bypass during the active season could overwinter in the bypass during the inactive season: these snakes may be vulnerable to inundation of the bypass and could be drowned or displaced from overwintering sites. However, most typically, Fremont Weir "notch" operations would occur on the shoulders of time periods in which the Sacramento River rises enough for Fremont Weir to overtop passively, without the proposed project. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Duration of inundation may also be an important factor determining effects on overwintering giant garter snakes. Radiotelemetry studies have revealed giant garter snakes surviving in burrows that had been inundated for 2 to 3 weeks, but it is unknown what duration of inundation the snakes can survive while overwintering in their burrows.

Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, of the BDCP provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect giant garter snakes overwintering in upland areas ranging from an estimated 582 acres of upland habitat during notch flow of 1,000 cfs to an estimated 1,402 acres during a 4,000-cfs notch flow. The 4,000-cfs notch flow would affect an estimated 888 acres of high value habitat and 514 acres of moderate value habitat.

As noted above under the discussion of habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of a maximum of 1,662 acres of rice fields (BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass*)*.* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term. Restoration and protection of 2,740 acres of rice land or habitat of equivalent value for the giant garter snake would achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 606 acres of upland habitat for the giant garter snake in the south Delta (CZ 7). The upland habitat to be inundated contains 432 acres of moderate-value and 174 acres of low-value habitat. The area between existing levees would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The restored floodplain will include a range of elevations from low-lying areas that flood frequently (e.g., every 1 to 2 years) to high-elevation areas that flood infrequently (e.g., every 10 years or more). There are no records of giant garter snakes in the vicinity of where floodplain restoration is expected to occur.

Based on modeled habitat for the giant garter snake, the study area supports approximately 53,285 acres of upland habitat for giant garter snake. Approximately 2.008 acres of giant garter snake upland habitat (4% of total upland habitat in the study area) may be adversely affected by periodic flooding as a consequence of floodplain restoration and the operation of the Fremont Weir.

NEPA Effects: Periodic effects on upland habitat for giant garter snake associated with implementing Alternative 4 are not expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, Alternative 4 would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect a total of approximately 2,008 acres of upland habitat for giant garter snake. The inundation could affect overwintering snakes. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that will be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.).

Therefore, increased inundation in the Yolo Bypass as a result of BDCP is expected to have a minimal effect on the Yolo Basin/Willow Slough population Therefore, implementing Alternative 4, including AMM1–AMM7, AMM10, and AMM16, would not be expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Periodic effects of inundation under Alternative 4 would have a less-than-significant impact on the species.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2A, Section 2A.30, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-4-23. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area.

Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP to benefit the western pond turtle (BDCP Chapter 3, *Conservation Strategy*).

- Protect or restore 142,200 acres of high-value natural communities and covered species habitats (Objective L1.1, associated with CM3).
- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise. Minimum restoration targets for tidal natural communities in each ROA are 7,000 acres in Suisun Marsh ROA, 5,000 acres in Cache Slough ROA, 1,500 acres in Cosumnes/Mokelumne ROA, 2,100 acres in West Delta ROA, and 5,000 acres in South Delta ROA (Objective L1.3, associated with CM2, CM3, and CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands (Objective L1.3), include sufficient transitional uplands along the fringes of restored brackish and freshwater

tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM3, CM4, and CM8).

- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Allow lateral river channel migration (Objective L2.2, associated with CM3 and CM5).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect and enhance 8,100 acres of managed wetland, 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3 and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-23. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 4[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic (acres)	335	335	2,005	2,005	NA	NA
	Upland (acres)[e]	261	261	84	84	NA	NA
	Aquatic (miles)	7	7	4	4	NA	NA
Total Impacts CM1 (acres)		**596**	**596**	**2,089**	**2,089**	NA	NA
CM2–CM18	Aquatic (acres)	82	114	23	44	NA	NA
	Upland (acres)[e]	414	1,028	119	136	283–798	331
	Aquatic (miles)	25	109	3	4	0	0
Total Impacts CM2–CM18 acres)		**496**	**1,142**	**142**	**180**	**283–798**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**1,092**	**1,738**	**2,231**	**2,269**	**283–798**	**331**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

[e] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 4 conservation measures would result in the permanent and temporary loss of up to 2,498 acres of aquatic habitat and 1,509 acres of upland nesting and overwintering habitat (Table 12-4-23). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, geotechnical investigations, and establishment and use of RTM, borrow, and spoils areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4) floodplain restoration (CM5), and riparian habitat restoration (CM7). Habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western pond turtle habitat. The activity accounting for most (80%) of the habitat loss or conversion would be *CM4 Tidal Natural Communities Restoration*. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent loss of approximately 335 acres of aquatic habitat and 261 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-4-23). Development of the water conveyance facilities would also result in the temporary removal of up to 2,005 acres of aquatic habitat and 84 acres of nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-4-23). Approximately 7 miles of channels providing western pond turtle movement habitat would be removed and 4 miles would be temporarily disturbed. There are four western pond turtle occurrences that overlap with the CM1 footprint in CZ 2, one occurrence that overlaps with an RTM area on the southern tip of Bouldin Island in CZ 5, and one occurrence that overlaps with an RTM area along Twin Cities Road in CZ 4.

An estimated 162 of the total 596 aquatic and upland acres combined and 4 of the 7 miles would be lost as storage areas for reusable tunnel material, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored: while this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. Furthermore, the amount of storage area needed for reusable tunnel material is flexible and the footprint used in the effects analysis is based on a worst case scenario: the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage.

The majority of the permanent loss of aquatic habitat and nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high-value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering and dispersal habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. While there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the pipeline footprint.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 249 acres of upland nesting and overwintering habitat for the western pond turtle. Approximately 4 miles of channels providing western pond turtle movement habitat would be permanently or temporarily removed as a result of Yolo Bypass improvements. Although there are no CNDDB occurrences for western pond turtle in the Yolo Bypass, the species is known to be present in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2013).

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of approximately 45 acres of aquatic habitat and 872 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Approximately 106 miles of channels providing western pond turtle movement habitat would be removed as a result of restoration. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration outside Suisun Marsh is likely to create suitable, slow-moving freshwater slough and marsh habitat.

Although the aquatic habitat model includes all tidal perennial aquatic, tidal brackish emergent wetland, and managed wetland as habitat, almost of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not hyrdrologically connected to Suisun Marsh (Patterson pers. comm.). While the model does not include an aquatic class type called *drainage ditches* and therefore an effect on this habitat type cannot be calculated, it is likely that this general type of habitat accounts for a very small portion of the total modeled aquatic effects; almost certainly less than 5%, or less than 287 acres of the modeled aquatic habitat affected by tidal restoration. The suitable nesting and overwintering habitat that would be affected in the interior of Suisun Marsh is limited, because the levees likely function as the primary nesting and overwintering habitat. The nesting and overwintering habitat of highest value to be affected is on the fringe of the marsh where the aquatic habitat is adjacent to undeveloped grassland habitat.

The habitat affected in the interior Delta (West Delta and South Delta) is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle. Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 53 acres of aquatic habitat and 33 acres of upland habitat for western pond turtle. Approximately 3 miles of channels providing western pond turtle movement habitat would be removed as a result of floodplain restoration. Although there are no CNDDB occurrences of the western pond turtle in the areas where floodplain restoration is likely to occur, the species is known to occur along the San Joaquin River to the south in the San Joaquin River National Wildlife Refuge. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration that is part of tidal natural communities restoration in CZ 1 and CZ 2, would result in the permanent removal of 10 acres of upland nesting and overwintering habitat for western pond turtle.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values over the term of the BDCP. In addition, effects would be avoided and minimized by the AMMs listed below.

  Management of the 6,600 acres of managed wetlands to be protected for waterfowl and shorebirds is not expected to result in overall adverse effects for the western pond turtle. Management actions that would improve wetland quality and diversity on managed wetlands include control and eradication of invasive plants; maintenance of a diversity of vegetation types and elevations, including upland areas to provide flood refugia; water management and leaching to reduce salinity; and enhancement of water management infrastructure (improvements to enhance drainage capacity, levee maintenance). These management actions could benefit the western pond turtle. The 6,600 acres of protected managed wetlands would be monitored and adaptively managed to ensure that management options are implemented to avoid adverse effects on the western pond turtle.

- Operations and maintenance: Ongoing maintenance of BDCP facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and conservation actions described below.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where conservation measures are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic or upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 4 would temporarily and permanently remove 2,445 acres of aquatic habitat and 878 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 2,340 acres of aquatic and 345 acres of upland habitats), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitats), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitats), and riparian restoration (CM7, 4 acres of upland habitat).

Typical project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 2,445 acres of aquatic habitat should be restored, 2,445 acres of aquatic habitat should be protected, and 1,756 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation. Because the number of acres required to meet the typical ratios described above would be only 2,445 acres of aquatic communities protected, 2,445 acres restored, and 1,756 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 4 on western pond turtles would not be adverse.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM17 Western Pond Turtle.* These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 4 would remove 2,498 acres of aquatic habitat and 1,509 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 4 as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 5%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun

Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

NEPA Effects**:** In the near-term, the loss of western pond turtle habitat under Alternative 4 would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of western pond turtle habitat associated with Alternative 4, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, the effects of Alternative 4 as a whole on western pond turtle would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 4 would temporarily and permanently remove 2,445 acres of aquatic habitat and 878 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 2,340 acres of aquatic and 345 acres of upland habitats), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitats), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitats) and riparian restoration (CM7, 4 acres of upland habitat) (Table 12-4-23).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 2,445 acres of aquatic habitat should be restored, 2,445 acres of aquatic habitat should be protected, and 1,756 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation for CEQA purposes. Because the number of acres required to meet the typical ratios described above would be only 2,445 acres of aquatic communities protected, 2,445 acres of aquatic communities, and 1,756 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 4 on western pond turtles would be less than significant.

In addition, the plan also contains commitments to implement AMM1–AMM6, AMM10, and AMM17, which include elements that would avoid or minimize the risk of directly and indirectly affecting habitats and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 4 would remove 2,498 acres of aquatic habitat and 1,509 acres of upland nesting and overwintering habitat for western pond turtle in the late long-term.

Implementation of Alternative 4 as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 5%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 48,625 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms will be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles because riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

The loss of western pond turtle habitat associated with Alternative 4 would represent a significant impact as a result of special-status species habitat modification and the potential for direct mortality of turtles. However, considering the habitat restoration and protection associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, which would be in place during all project activities, the loss of habitat and potential mortality would not have a significant impact on western pond turtle. Therefore, the loss of western pond turtle habitat and potential mortality of turtles from Alternative 4 would have a less-than-significant impact on western pond turtle.

Impact BIO-53: Indirect Effects of Plan Implementation on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting, overwintering, and dispersal habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, conservation components, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances over the term of the BDCP.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

Water operations would affect salinity gradients in Suisun Marsh. This effect mechanism cannot be disaggregated from tidal natural community restoration in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operation of salinity control gates to mimic a more natural water flow. Results of modeling for full implementation of the BDCP show salinity to double by the late long-term compared with current conditions during late fall and winter months. Changes in salinity would not be uniform across Suisun Marsh, as salinity would likely be more pronounced in some tidal channels and sloughs than others, and most of the salinity increase would occur during the fall and winter. Western pond turtles are primarily a freshwater species, although they can also be found in brackish marsh, and could respond negatively to increased salinity in Suisun Marsh. However, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not connected to tidal channels and sloughs in Suisun Marsh which is where increases in salinity would occur. Therefore, the potential effects associated with changes in salinity are not expected to adversely affect western pond turtles.

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4, the BDPC would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. Changes in water salinity would have a less-than-significant impact on western pond turtles because most of the salinity increases would occur in areas not used extensively by western pond turtles.

With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4 construction, operation, and maintenance, the BDCP would avoid the potential for significant impacts on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 4 would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement would result in periodic inundation that could affect western pond turtle and its upland habitat. BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect from an estimated 283 acres of habitat during 1,000 cfs notch flow to an estimated 798 acres of habitat during 4,000 cfs notch flow (Table 12-4-23). This effect would occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal overwintering habitat for the western pond turtle under Existing Conditions. Furthermore, Yolo Bypass inundation is not expected to affect nesting western pond turtles because operations would not occur during the nesting season (approximately May through October). Therefore, Yolo Bypass operations are expect to have a minimal effect, if any, on western pond turtles in the Yolo Bypass.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 331 acres of upland habitat for the western pond turtle in the south Delta (CZ 7). Seasonal flooding in restored floodplains is not expected to adversely affect aquatic and dispersal habitat, because these habitat functions are expected to remain in the seasonally inundated floodplains. Floodplains are not expected to be inundated during the nesting season, however, turtle hatchlings may overwinter in the nest and could be affected by flooding. Restored floodplains would transition for areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more); adverse effects on turtle hatchlings are most likely at the lower elevations of the restored floodplain, where frequent flooding occurs.

NEPA Effects: Periodic effects on upland habitat for western pond turtle from CM2 and CM5 associated with implementing Alternative 4 are not expected to result in substantial adverse effects either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Therefore, Alternative 4 would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect 283-798 acres from CM2 and approximately 331 acres from CM5 of upland habitat for western pond turtle. These acreages represent only 1% of the total upland western pond turtle habitat in the study area. Most of the increase in inundation would occur in the winter and early spring months, when western pond turtles may be in the water or overwintering and occupying upland habitats. Therefore, implementing Alternative 4, including AMM1–AMM6, AMM10, and AMM17, would not be expected to result in significant impacts on western pond turtle, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Periodic effects of inundation under Alternative 4 would have a less-than-significant impact on the species.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 4 on the silvery legless lizard, San Joaquin coachwhip and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10), (Figure 12-17). There are isolated patches of sandy habitat in the vicinity of Oakley and along the railroad in the East Bay Regional Park Legless Lizard Preserve that are not shown in Figure 12-17 because project mapping was not available at this level of detail. Because none of these areas would be affected by construction or restoration activities, this species is not discussed any further. The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the whipsnake in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4). Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013). In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Alternative 4 is expected to result in the temporary and permanent removal of habitat that special-status reptiles uses for cover and dispersal (Table 12-4-24). BDCP actions that could affect this habitat are limited to construction and maintenance of the water conveyance facilities in the vicinity of Clifton Court Forebay, and grassland restoration, protection and management. Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP that would also benefit special-status reptiles (see Chapter 3, *Conservation Strategy*, of the BDCP).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).

- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-24. Changes in Special-Status Reptile Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Grassland	269	269	102	102	NA	NA
Total Impacts CM1		**269**	**269**	**102**	**102**	**NA**	**NA**
CM2–CM18	Grassland	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**269**	**269**	**102**	**102**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] Grassland impacts include alkali seasonal wetland complex, grassland, and inland dune scrub natural communities.
[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[e] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 4 conservation measures would result in the permanent and temporary loss of 371 acres of habitat for special-status reptiles (Table 12-4-24). Water conveyance facilities and transmission line construction, including establishment and use of RTM, borrow, and spoils areas, and geotechnical investigations (CM1) would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effect are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though this would result in slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4 where it does not occur.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to conservation components could have similar effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 269 acres of habitat for special-status reptiles in the vicinity of Clifton Court Forebay. Construction-related effects would temporarily disturb 102 acres of suitable habitat for special-status reptiles in the study area. There are no occurrences of either species within the construction footprint for CM1.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55 *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs.*
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicles may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. *P. blainvillii* may only be active during the early morning and evening hours in the summer (Morey 2000). Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence

of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Alternative 4 would remove 371 acres of grassland habitat for special-status reptiles as a result of CM1.

The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that 742 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, to avoid and minimize injury or mortality of special-status reptiles during construction, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species from Alternative 4 would not be an adverse effect.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of 371 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan Area. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1 and GNC1.2). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would replace unsuitable special-status reptile habitat, such as cultivated land, with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because Alternative 4 would result in a net increase in acreage of grassland habitat in the study area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

NEPA Effects: In the near-term and late long-term, the loss of special-status reptile habitat under Alternative 4 would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above and because of the implementation of Mitigation Measure BIO-55.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant under CEQA. Alternative 4 would remove 371 acres of grassland habitat for special-status reptiles as a result of CM1.

The typical CEQA mitigation ratio (2:1 for protection) for this natural community would indicate that 742 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which would be close enough to the timing of construction impacts to constitute mitigation for CEQA purposes. The restoration and protection activities associated with the BDCP conservation strategy would be sufficient to support the conclusion that the near-term impacts of permanent and temporary loss of special-status reptile habitat of either species would be less than significant under CEQA. A significant impact could occur related to the potential for mortality; however, with implementation of Mitigation Measure BIO-55, the impact related to the potential mortality of either species would also be less than significant because this measure would require that special-status reptiles present in the construction work areas be relocated and that other avoidance and minimization measures be taken to reduce the risk for impacts.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of 371 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan Area (Objective GNC1.1 and Objective GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would replace unsuitable special-status reptile habitat, such as cultivated land, with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because Alternative 4 would result in a net increase in acreage of grassland habitat in the study area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the significant impacts resulting from water conveyance facilities construction. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species under Alternative 4 would not result in a significant impact under CEQA.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support noncovered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work areas, the biologist will the first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas of suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM10 Restoration of Temporarily Affected Natural Communities*, will be implemented for all noncovered special-status reptiles adversely affected by the BDCP to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Plan Implementation on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat over the term of the BDCP.

In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of AMM10. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

NEPA Effects: Implementation of the Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4 on special-status reptiles would not be adverse under NEPA.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present, which would be a significant impact.

With implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* as part of Alternative 4 construction, operation, and maintenance, the BDCP would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4 would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on California black rail. The habitat model used to assess effects for the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta includes all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat includes all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones that provide refugia during high tides within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-4-25. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the California black rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 1,700 acres of black rail habitat between restored tidal freshwater emergent wetlands and transitional uplands to provide upland refugia (Objective CBR1.1, associated with CM4).
- Create topographic heterogeneity in restored tidal brackish and freshwater emergent wetlands (Objectives TBEWNC1.4 and TFEWNC2.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management* as revised in Appendix 11F, *Substantive BDCP Revisions*) and implementation of AMM1–AMM7, *AMM39 California Black Rail*, and *AMM27 Selenium Management* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*), impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-25. Changes in California Black Rail Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0.5	0.5	11	11	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0.5**	**0.5**	**11**	**11**	**NA**	**NA**
CM2–CM18	Primary	76	84	0	0	0-9	0
	Secondary	986	3,044	0	0	0	6
Total Impacts CM2–CM18		**1,062**	**3,128**	**0**	**0**	**0-9**	**6**
TOTAL IMPACTS		**1,062.5**	**3,128.5**	**11**	**11**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 95.5 acres of modeled primary habitat, and up to 3,044 acres of modeled secondary habitat for California black rail (Table 12-4-25). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1) and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below. A summary statement of the combined NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent loss of up to 0.5 acres and the temporary loss of up to 11 acres of modeled primary California black rail habitat (Table 12-4-25). The construction of a temporary transmission line in the central Delta that extends from Bouldin Island to Victoria Island would impact modeled habitat on Mandeville Island, the north end of Bacon Island, and on in-channel islands along the transmission line alignment. Other temporary impacts on modeled habitat would occur from a temporary barge unloading facility and a temporary access road along the north end of Bacon Island, and from a temporary work area on Mandeveille Island. Geotechnical exploration could also impact black rail habitat on an in-channel island east of Bacon Island. Less than 0.5 acre of habitat would be permanently lost from the construction of a permanent transmission line at the northeast corner of Clifton Court Forebay in CZ 8. The CM1 footprint intersects with one California black rail occurrence on Mandeville Island, from the footprint of the temporary transmission line. The implementation of *AMM38 California Black Rail* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*) would minimize the effects of construction on rails if present in or adjacent to the work area. Refer to the Terrestrial Biology Mapbook for a detailed views of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction or channel modification from fish passage improvements associated with the Yolo Bypass would result in the permanent removal of approximately 5 acres of primary California black rail habitat in CZ 2. There are no occurrences of California black rail that intersect with the CM1 footprint. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be affected by tidal marsh restoration. Some California black rail modeled habitat would be permanently lost such that it no longer serves as habitat, while other modeled habitat would change value through conversion from one habitat type to another. Tidal habitat restoration site preparation and inundation would result in the permanent loss of 79 acres of primary habitat and 3,044 acres of secondary habitat for California black rail. Of the 79 acres of primary habitat lost, an estimated 76 acres would be converted to low marsh, or secondary habitat, for the species due to increased water elevations.

  The majority of the effects of tidal natural communities restoration would occur in Suisun Marsh (CZ 11). Much of the natural wetland habitat that would be removed occurs in isolated patches and would be replaced by larger continuous areas of tidal wetlands that are expected to support higher habitat functions for the rail than the impacted wetlands. As described in the BDCP, restoration of up to 24,000 acres of tidal freshwater emergent wetland in the Delta and at least 6,000 acres of tidal brackish emergent wetland natural communities in CZ 11 by the late long-term would benefit California black rail. The primary habitat for the species in the Delta consists of inchannel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under CM4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration projects would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

  The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before the initiation of restoration actions in other areas. However, California black rails have a greater use of mature tidal marshes and, therefore, it would be years before the newly restored marshes provided suitable habitat for the species. In the long-term, tidal natural communities restoration is expected to have little to no adverse effects on California black rail habitat because the habitat removed would be replaced by a greater acreage of high-value tidal wetland and, thus, is expected to provide a benefit for California black rail.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions contained in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values over the term of the BDCP. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Additional actions under CM11 include the control of nonnative predators to reduce nest predation as needed.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the surrounding habitat in Suisun and the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California black rail. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, injury or mortality of the species during project activities would be minimized by establishing 500-foot no-disturbance buffers around identified territorial calling centers during the breeding season, as required by *AMM38 California Black Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 4 implementation, there would be a loss of 1,073.5 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 11.5 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland.

Using this ratio would indicate that 11.5 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of 11.5 acres of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California black rail satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on California black rail: *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. *AMM38 California Black Rail* requires surveys for California black rail and the implementation of avoidance and minimization measures, including the establishment of a 500-foot no disturbance buffer around any identified calling stations. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 95.5 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

NEPA Effects: The loss of California black rail habitat and potential direct mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by the biological objectives for the species and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*, which would be in place during all project activities, the effects of Alternative 4 as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 4 implementation, there would be a loss of 1,073.5 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 11.5 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*–76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 11.5 acres of tidal natural communities should be restored/created to mitigate the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on California black rail: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, and AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the loss of California black rail habitat and potential direct mortality of this species under Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management, and enhancement activities. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and implementation of those measures designed to offset those impacts on natural communities and the species that use them. In addition, AMM38 California Black Rail and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 1,084 acres of restored/created tidal natural communities, the 10,850 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological goals and objectives for California black rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 4 would be less than significant under CEQA. No mitigation would be required.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 95.5 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (1% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickelweed and bulrush cover, serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the

AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

In the absence of other conservation actions, the loss of California black rail habitat and potential direct mortality of this species under Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. This impact would be considered significant. However, the BDCP has committed to habitat protection, restoration, management, and enhancement activities. Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

A variety of rail species are known to suffer mortality from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al.1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires. California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al, 1994). There are numerous occurrences within 1 mile of the proposed temporary transmission line, which extends north-south between Bouldin Island and Clifton Court Forebay. However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would eliminate any potential for mortality of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for temporary transmission lines constructed in the Delta to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for California black rails from the project. The increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California black rail because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would eliminate or nearly eliminate the risk of bird strike for California black rails from the project. The increase in predation risk on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Plan Implementation on California Black Rail

Indirect Construction-Related Effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there is no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM38 California Black Rail* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*,) that preconstruction surveys of potential breeding habitat would be conducted within 700 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008); however, the majority of the overlap between restoration areas and black rail habitat is within Suisun Marsh, where conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Conservation Measure CM 12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on California black rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California black rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances related to construction-related activities from conservation measures could disturb California black rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California black rail would be minimized with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is Black Rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Noise and visual disturbances related to construction-related activities and other conservation measures could disturb primary and secondary California black rail habitat adjacent to work sites. *AMM38 California Black Rail* would avoid and minimize impacts on California black rail from noise and visual disturbance. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species. These impacts on California black rail would be less than significant with the incorporation of AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is Black Rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and potentially temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *CM4 Tidal Natural Community Restoration* activities. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

***NEPA Effects*:** The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize impacts on California black rail. No mitigation would be required.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would not result in the periodic inundation of modeled habitat for California black rail. There are no records for California black rails in the Yolo Bypass, although the species is highly secretive and the extent to which the area has been surveyed for California black rails is unknown. Therefore, there is potential for the species to occur in the Yolo Bypass. In addition, rails may occur in the bypass after restoration activities are completed. However, periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in increased magnitude, frequency and duration of periodic inundation by up to 6 acres of modeled California black rail habitat in CZ 7. The risk of changes in inundation frequency, magnitude, and duration through CM2 and CM5 affecting California black rail are considered to be low, and would not be expected to result in adverse effects on the species.

NEPA Effects: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration through CM2 and CM5 affecting California black rail is considered to be low.

CEQA Conclusion: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would represent a less-than-significant impact on California black rail because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration as a result of CM2 and CM5 affecting California black rail is considered to be low. No mitigation would be required.

California Clapper Rail[1]

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on California clapper rail. California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant

[1] Based on recent genetic studies by Maley and Brumfield (2013) and Chesser et al. (2014), the "California" (*Rallus longirostris obsoletus*), "Yuma" (*R. l. yumanensis*), and "light-footed" (*R. l. levipes*) subspecies of clapper rail are now recognized by the American Ornithologists' Union (AOU) as a separate species: Ridgway's rail (*Rallus obsoletus*). As such, the taxon formerly known as California clapper rail (*R. l. obsoletus*) is now California Ridgway's rail (*R. o. obsoletus*). For the purposes of this document, the "California clapper rail" common name has been retained due to its use in previous BDCP documents.

alliances. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rail secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and foraging opportunities. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Covered Species Accounts*.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-4-26. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the California clapper rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management* as revised in Appendix 11F, *Substantive BDCP Revisions*) and implementation of AMM1–AMM7, *AMM19 California Clapper Rail*, and *AMM27 Selenium Management* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*,), impacts on the California clapper rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-26. Changes in California Clapper Rail Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	Primary	26	27	0	0	NA	NA
	Secondary	50	50	0	0	NA	NA
Total Impacts CM2–CM18		**76**	**77**	**0**	**0**		
TOTAL IMPACTS		**76**	**77**	**0**	**0**		

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

Alternative 4 conservation measures would result in the total loss or conversion of up to 35 acres of modeled clapper rail habitat consisting of 27 acres of primary habitat and 50 acres of secondary habitat (Table 12-4-26). The conservation measure that would result in these losses is tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would convert approximately 77 acres of modeled California clapper rail habitat (27 acres of primary habitat, 50 acres of secondary habitat), the majority of which would occur in CZ 11. The tidal marsh restoration action would not result in the permanent loss of any California clapper rail habitat in the study area. However, approximately 27 acres of primary habitat would be converted to secondary low marsh habitat and 50 acres of secondary habitat would be converted to middle or high marsh. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11. Tidal wetlands would be restored as a mosaic of large, interconnected, and biologically diverse patches that supported a natural gradient extending from subtidal to the upland fringe. Much of the restored tidal brackish emergent wetland would meet the primary habitat requirements of the California clapper rail, including development of mid- and high-marsh vegetation with dense, tall stands of pickleweed cover. Restoration would be sequenced and spaced in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.

- *CM11 Natural Communities Enhancement and Management*: Because the entire California clapper rail population is restricted to the San Francisco Bay Area estuary, BDCP enhancement and restoration actions would be expected to benefit the species by creating the potential for extending its abundance and distribution in Suisun Marsh. Occupied California clapper rail habitat would be monitored to determine if there is a need for predator control actions. If implemented, nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats could result in localized ground disturbances that could temporarily remove small amounts of California clapper rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available California clapper rail habitat. These potential effects are currently not quantifiable, but would be minimized with implementation of *AMM19 California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect California clapper rail use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California clapper rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, and habitat restoration, enhancement, and management could result in injury or mortality of California clapper rail. Operation of construction equipment could result in injury or mortality of California clapper rails. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is less likely as these individuals are expected to avoid contact with construction equipment. However, nest sites would be avoided during the nesting season as required by AMM1–AMM7 and *AMM19 California Clapper Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to compensate for the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4). These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19*

California Clapper Rail. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and to 50 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and at least 1,500 acres of the restored marsh would consist of middle-and high-marsh vegetation, serving as primary habitat for California clapper rail in Suisun Marsh (Objectives TBEWNC1.1 and TBEWNC1.2). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of California clapper rail habitat associated with Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*, which would be in place during all project activities, the effects of Alternative 4 as a whole on clapper rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term from the implementation of *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the study area. These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4).

These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the loss of California clapper rail habitat and potential direct mortality of this species under Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and implementation of those measures designed to offset those impacts on natural communities and the species that use them. In addition, *AMM19 California Clapper Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 76 acres of restored tidal natural communities, the 2,000 acres of tidal brackish emergent wetland restoration contained in the near-term Plan goals, and the additional detail in the biological objectives for California clapper rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and to 8 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickelweed, serving as primary habitat for clapper rail in Suisun Marsh (Objective TBEWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California clapper rail.

Impact BIO-63: Indirect Effects of Plan Implementation on California Clapper Rail

Indirect Construction-Related Effects: California clapper rail habitat within the vicinity of proposed restoration areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect California clapper rail. The use of mechanical equipment during construction-related restoration activities could cause the accidental release of petroleum or other contaminants that could affect clapper rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM19 California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) that preconstruction surveys of potential breeding habitat would be conducted within 500 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Preconstruction surveys conducted under *AMM19 California Clapper Rail* would ensure construction-related noise and visual disturbances would not have an adverse effect on California clapper rail. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and ensure measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Therefore, with the implementation of AMM1–AMM7 and *AMM19 California Clapper Rail*, there would be no adverse effect on California clapper rail.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which would be beneficial to California clapper rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rails are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on California clapper rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the California clapper rail. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which

forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California clapper rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on California clapper rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California clapper rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California clapper rail would be minimized with *AMM19 California Clapper Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration Actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions.

However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, changes in salinity, and increased exposure to selenium from Alternative 4 implementation would not have an adverse effect on California clapper rail.

***CEQA Conclusion*:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. *AMM19 California Clapper Rail* would avoid and minimize impacts on California clapper rail from noise and visual disturbance. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants or the inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat which could adversely affect the species. These impacts on California clapper rail would be less than significant with the incorporation of AMM1–AMM7 into the BDCP.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California clapper rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species. Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the study area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to 3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to movements of California clapper rail. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and, thus, temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California clapper rail or restoration activities resulting in barriers to movement would be minimized through sequencing of restoration activities to minimize effects of temporary habitat loss. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California clapper rail as a result of special-status species habitat modification because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California clapper rail as a result of habitat modification of a special status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before initiating restoration actions in other areas. In addition, In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

California Least Tern

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of California least tern modeled foraging habitat as indicated in Table 12-4-27. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit California least tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect at least 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the at least 65,000 acres of tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation).

As explained below, with the restoration and protection of tidal perennial aquatic foraging habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management* as revised in Appendix 11F, *Substantive BDCP Revisions*) and implementation of AMM1–AMM7, *AMM27 Selenium Management* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*), and mitigation to avoid impacts on terns should they nest in the study area, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-27. Changes in California Least Tern Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Foraging	281	281	2,019	2,019	NA	NA
Total Impacts CM1		**281**	**281**	**2,019**	**2,019**	**NA**	**NA**
CM2–CM18	Foraging	38	46	11	16	NA	NA
Total Impacts CM2–CM18		**38**	**46**	**11**	**16**	**NA**	**NA**
TOTAL IMPACTS		**319**	**327**	**2,030**	**2,035**	**NA**	**NA**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 2,362 acres of modeled foraging habitat for California least tern (Table 12-4-27). The conservation measures that would result in these losses are construction of water conveyance facilities and operation (CM1), Yolo Bypass Fisheries Enhancement (CM2), Tidal Natural Communities Restoration (CM4), and Seasonally Inundated Floodplain Restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,300 acres of modeled California least tern aquatic foraging habitat (Table 12-4-27). Of these acres, 281 acres would be a permanent loss the majority of which would occur where Intakes 2, 3 and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest affect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at three locations along the tunnel route. The CM1 footprint does not overlap with any California least tern occurrences. Refer to the Terrestrial Biology Mapbook for a detailed views of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of Yolo Bypass fisheries enhancement (CM2) would result in the permanent loss of 8 acres and the temporary loss of 11 acres of modeled aquatic foraging habitat for California least tern in CZ 2. Activities from Fremont and Sacramento Weir improvements, Putah Creek realignment, and Lisbon Weir modification could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration actions would result in the permanent loss of 36 acres of modeled aquatic foraging habitat for California least tern. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic would be restored, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration is consistent with BDCP Objective TPANC1.1. Tidal perennial aquatic restoration would be expected to substantially increase the primary productivity of fish, increasing the prey base for California least tern. Approximately 3,400 acres of the restoration would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be phased over the following 30 years. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would result in the permanent loss of 2 acres and the temporary loss of 5 acres of modeled aquatic foraging habitat for California least tern. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers.
- *CM11 Natural Communities Enhancement and Management:* Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and injury mortality and noise and visual disturbance of nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic postconstruction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the BDCP. Maintenance activities would

include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs listed below.

- Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in Suisun Marsh and west Delta area (CZ 10 and CZ 11). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or mortality would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraph summarizes the combined effects discussed above and describes other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 4 implementation, there would be a loss of 2,349 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,300 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 2,300 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3, *Description of Alternatives*).This conservation action would result in the creation of approximately 3,400 acres of high quality tidal perennial aquatic natural community, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment, Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*).

Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The California least tern is not a species that is covered under the BDCP. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would be available to address this adverse effect on nesting California least terns.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 2,362 acres of foraging habitat during the term of the Plan (3% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* would restore an estimated 27,000 acres of high quality tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 4 would represent an adverse effect in the absence of other conservation actions. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this effect on nesting California least terns. With habitat restoration associated with CM4, guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 4 as a whole on California least tern would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 4 implementation, there would be a loss of 2,349 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,300 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 2,300 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (see Table 3-4 in Chapter 3, *Description of Alternatives*). Modeling conducted by ESA PWA indicates that this conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Spoils, Reusable Tunnel Material,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*,of the Final EIR/EIS.

In the absence of other conservation measures, the effects on California least tern habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. Implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would reduce the impact on nesting California least terns to a less-than-significant level. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and implementation of those measures designed to offset those impacts on natural communities and the species that use them. In addition, AMM1–AMM7 and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 2,309 acres of restored tidal perennial aquatic habitat, the 3,400 acres of tidal perennial aquatic restoration estimated in the near-term, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 4 would be less than significant under CEQA. No mitigation would be required.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 2,362 acres of foraging habitat during the term of the Plan (3% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through CM4 Tidal Natural Communities Restoration to restore an estimated 27,000 acres of high-value tidal perennial aquatic natural community (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

In the absence of other conservation actions, the loss of California least tern foraging habitat and potential direct mortality associated with Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 4 would represent a significant impact in the absence of other conservation actions.

However, with habitat restoration associated with CM4, guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimize*d, the loss of habitat or mortality under this alternative would have a less-than-significant impact on California least tern. No mitigation would be required.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of

California least tern nesting colonies. No construction will take place within 500 feet California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of Plan Implementation on California Least Tern

Indirect Construction- and Operation-Related Effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern.

The operational impacts of new flows under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and large mouth bass tissues were insignificant (see BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in the BDCP, Appendix 5.D, *Contaminants*).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would be available to address this potential adverse effect. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-AMM7, AMM12, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of mortality of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would substantially reduce the potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern

***CEQA Conclusion*:** The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes “roosting and foraging” and “foraging” habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (BDCP Appendix 2.A).

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-4-28. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).

- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).
- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management* as revised in Appendix 11F, *Substantive BDCP Revisions*) and implementation of AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*), impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-28. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Roosting and Foraging - Permanent	0	0	4	4	NA	NA
	Roosting and Foraging - Temporary	16	16	71	71	NA	NA
	Foraging	1,695	1,695	772	772	NA	NA
Total Impacts CM1		**1,711**	**1,711**	**847**	**847**	**NA**	**NA**
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	2,776	4,367	0	0	0	0
Total Impacts CM2–CM18		**2,776**	**4,408**	**0**	**0**	**0**	**0**
Total Roosting/Foraging – Permanent		**0**	**0**	**4**	**4**	**0**	**0**
Total Roosting/Foraging – Temporary		**16**	**57**	**71**	**71**	**0**	**0**
Total Foraging		**4,471**	**6,062**	**772**	**772**	**0**	**0**
TOTAL IMPACTS		**4,487**	**6,119**	**847**	**847**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 128 acres of modeled roosting and foraging habitat (57 acres of permanent loss, 71 acres of temporary loss) and 6,834 acres of foraging habitat for greater sandhill crane (6,062 of permanent loss, 772 acres of temporary loss; see Table 12-4-28). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities as they are currently designed would result in the combined permanent loss of up to 1,711acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,695 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 1,050 acres of very high-value, 180 acres of medium-value, and 465 acres of low-value foraging habitat (Table 12-4-29). In addition, 4 acres of permanent roosting and foraging habitat, 71 acres of temporary roosting and foraging habitat, and 772 acres of foraging habitat would be temporarily removed (Table 12-4-29). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction; however, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. CM1 activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

  The acres of roosting and foraging habitat that would be removed would occur from the construction of a temporary transmission line on Zacharias Island, Bouldin Island, and Venice Island and from the construction of a temporary concrete batch plant and a permanent access road on Bouldin Island; however, the implementation of *AMM20 Greater Sandhill Crane* would require that CM1 activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for greater sandhill crane bird strike on electrical transmission facilities is addressed below under Impact BIO-70.

  Approximately 1,502 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

  Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for greater sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-70.

The effects of noise and visual disturbance from CM1 construction activities are discussed under Impact BIO-71. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

Table 12-4-29. Value of Greater Sandhill Crane Foraging Habitat affected by Alternative 4

Foraging Habitat Value Class	Land Cover Type	Acres Affected by CM1 permanent [temporary] (acres)	Acres Affected by CM2–CM18 [permanent] (acres)
Very high	Corn, rice	1,050 [216]	1,155 (0)
High	Wheat, managed wetlands,	0 [21]	489 (0)
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	180 [307]	1,403 (0)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	465 [229]	1,320 (0)
Total		**1,695 [772]**	**4,367**

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 2,754 acres of greater sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 2,713 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 716 acres of very high-value, 304 acres of high value, 873acres of medium-value, and 821 acres of low-value foraging habitat This loss would occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. In CZ 5, loss of modeled habitat would occur along the western edge of the greater sandhill crane winter use area and therefore would not result in fragmentation of traditional crane habitats. Therefore fragmentation of habitat from tidal restoration activities would be expected to be minimal. Approximately 1,951 acres of foraging habitat would be impacted within the first 10 years of Alternative 4 implementation.
- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands that provide foraging habitat for greater sandhill crane would be converted to grassland by the late long-term timeframe. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the greater sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Alternative 4 implementation.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the greater sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 4 implementation.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, greater sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of Alternative 4 implementation).
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. The potential for injury and direct mortality from electrical transmission facilities is discussed below under Impact BIO-70.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, Alternative 4 would remove 91 acres roosting and foraging habitat (16 acres of permanent loss, 75 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 5,243 acres of foraging habitat would be removed or converted in the near-term (CM1, 2,467 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 3,708 acres would be medium- to very high-value habitat (CM1,1,773 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of medium- to very high-value foraging habitat. Using these ratios would indicate that 91 acres of greater sandhill crane roosting habitat should be restored/created and 91 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 1,773 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 91 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 132 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 6,834acres of foraging habitat (4% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 4,820 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering habitat protection, restoration, management, and enhancement would be guided by performance standards, and the aforementioned AMMs, which would be in place throughout the period of construction, greater sandhill crane habitat losses and conversions under Alternative 4 would not be an adverse effect under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, Alternative 4 would remove 91 acres roosting and foraging habitat (16 acres of permanent loss, 75 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1). In addition, 5,243 acres of foraging habitat would be removed or converted in the near-term (CM1, 2,567 acres; *CM4 Tidal Natural Communities*

Restoration, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 3,708 acres would be medium- to very high-value habitat (CM1, 1,773 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of medium- to very high-value foraging habitat. Using these ratios would indicate that 91 acres of greater roosting habitat should be restored/created and 91 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 1,773 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of medium- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 91 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities. Considering the conservation actions described above, and AMM1–AMM7 and AMM20, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, Alternative 4 would have a less-than-significant impact on greater sandhill cranes. No mitigation would be required.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 132 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 6,834 acres of foraging habitat (4% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 4,820 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Considering Alternative 4's protection and restoration provisions, in addition to Mitigation Measure BIO-69a, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1 prior to or concurrent with impacts, loss of habitat and direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 4 would have a less-than-significant impact on greater sandhill crane.

Mitigation Measure BIO-69a: Compensate for the Loss of Medium- to Very High-Value Greater Sandhill Crane Foraging Habitat

DWR must compensate for loss of greater sandhill crane medium to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts, to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging habitat value categories are listed in Table 12-4-29. Foraging habitat conservation must occur within the greater sandhill crane winter use area and the location of protected habitat or conservation easements must be preapproved by the USFWS and CDFW.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4 facilities, as described below. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines was estimated for the BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Alternative 4 substantially reduced the length of permanent and temporary transmission lines as compared to the BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4, no permanent transmission lines would be constructed within the greater sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4 transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin

Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by greater sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4 as compared to the BDCP.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. In addition, after the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4 meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would substantially reduce the potential for crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters will be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing mortality in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of

Alternative 4 implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4 would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4 implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, and the construction and operation of transmission lines under Alternative 4 would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of Plan Implementation on Greater Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane*, which is described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (Appendix 11F, *Substantive BDCP Revisions*). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4-30). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-4-30. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 4 (acres)

	General Construction	
Habitat Type	Above 60 dBA	Above 50 dBA
Permanent Roosting	196	1,008
Temporary Roosting	810	1,909
Foraging	7,676	17,327
Total Habitat	**8,681**	**20,243**

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see Chapter 5, *Effects Analysis*, of the BDCP). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (see BDCP Chapter 5, *Effects Analysis*, of the BDCP). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see BDCP Chapter 5, *Effects Analysis*, of the BDCP).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species, including greater sandhill crane. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on greater sandhill crane. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Therefore, potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect greater sandhill crane via uptake in lower trophic levels (BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in greater sandhill cranes would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 4 would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on greater sandhill crane.

Lesser Sandhill Crane

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. Suitable roosting and foraging habitat in the study area includes certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and that also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (BDCP Appendix 2.A, *Covered Species Accounts*). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser Sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-4-31. Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP for the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*) that would also benefit the lesser sandhill crane.

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).
- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 will involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Created habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).
- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise

and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).

- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management* as revised in Appendix 11F) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines* (as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*), impacts on the lesser sandhill crane would be less than significant for CEQA purposes, and would not be adverse for NEPA purposes.

Table 12-4-31. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Roosting and Foraging - Permanent	0	0	4	4	NA	NA
	Roosting and Foraging - Temporary	16	16	71	71	NA	NA
	Foraging	1,707	1,707	860	860	NA	NA
Total Impacts CM1		**1,723**	**1,723**	**935**	**935**		
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	3,610	12,172	2	4	0	0
Total Impacts CM2–CM18		**3,610**	**12,213**	**2**	**4**	**0**	**0**
Total Roosting and Foraging - Permanent		**0**	**0**	**4**	**4**		
Total Roosting and Foraging - Temporary		**16**	**57**	**71**	**71**		
Total Foraging		**5,371**	**13,879**	**862**	**864**		
TOTAL IMPACTS		**5,333**	**13,936**	**937**	**939**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 132 acres of modeled roosting and foraging habitat (57 acres of permanent loss, 75 acres of temporary loss) and 14,743 acres of foraging habitat (13,879 acres of permanent loss, 864 acres of temporary loss, Table 12-4-31). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass Fisheries Improvements (CM2), Tidal Natural Communities Restoration (CM4), Seasonally Inundated Floodplain Restoration (CM5), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent loss of up to 1,723 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,707 acres of foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 1,018 acres of very high-value, 135 acres of high-value, and 301 acres of medium-value foraging habitat (Table 12-4-32). In addition, 4 acres of permanent roosting and foraging habitat, 71 acres of temporary roosting and foraging habitat, and 860 acres of foraging habitat would be temporarily removed (Table 12-4-31). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands. CM1 activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

  The acres of temporary and permanent roosting and foraging habitat that would be permanently removed is located on Bouldin Island, from the construction of a permanent access road. Temporary impacts on roosting and foraging habitat would occur on Bouldin Island from the construction of a temporary concrete batch plant and a fuel station. Temporary losses would also occur from the construction of temporary transmission lines between the Lambert Road vent shaft and the intermediate forebay, and on Venice Island. However, the implementation of *AMM20 Greater Sandhill Crane* would require that CM1 activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described for *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

  Approximately 1,502 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would be stored on Bouldin Island, Zacharias Island and parcels south of Lambert Road and north of the Cosumnes River. The reusable tunnel material would likely be moved to other sites for use in levee build-up and restoration, and the affected areas would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils,* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

Table 12-4-32. Value of Lesser Sandhill Crane Foraging Habitat Affected By Alternative 4

Foraging Habitat Value Class	Land Cover Type	CM1 Permanent (Temporary)	CM2-CM18 Permanent (Temporary)
Very high	Corn, alfalfa and alfalfa mixtures	1,018(319)	4,083 (0)
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	135 (124)	2,058 (0)
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, non-irrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	301 (201)	2,220 (2)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	242 (205)	3,745 (2)
None	Vineyards, orchards	12 (10)	23 (0)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction under CM2 would result in a permanent loss of 267 acres and a temporary loss of 2 acres of lesser sandhill crane foraging habitat in CZ 2. Lesser sandhill crane use in this area is less common than in the central Delta.
- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 10,248 acres of lesser sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 10,207 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 3,642 acres of very high-value, 1,529 acres of high value, 2,040 acres of medium-value, and 2,983 acres of low-value foraging habitat (Table 12-4-32). Habitat loss would primarily occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. Lesser sandhill cranes are less traditional than greater sandhill cranes and would be more adaptable to changes in land use. Approximately 2,516 acres of foraging habitat would be removed within the first 10 years of Alternative 4 implementation.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees would result in the loss of 2 acres of low-value lesser sandhill crane foraging habitat (1 acre of permanent loss, 1

acres of temporary loss). This impact would occur after the first 10 years of Alternative 4 implementation.

- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands (foraging habitat) would be converted to grassland. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the lesser sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Plan implementation.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the lesser sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 4 implementation.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of Alternative 4 implementation).
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. Injury and mortality from electrical transmission facilities are described below under Impact BIO-73.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, Alternative 4 would remove 91 acres of permanent and temporary roosting and foraging habitat (16 acres of permanent loss, 75 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 91 acres). In addition, 6,179 acres of foraging habitat would be removed or converted in the near-term (CM1, 2,567 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 4,605 acres would be medium- to very high-value habitat (CM1, 2,098 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 91 acres of lesser sandhill crane roosting habitat should be restored/created and 91 acres should be protected to compensate for the CM1 losses of lesser sandhill crane permanent and temporary roosting and foraging habitat. In addition, 2,098 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 91 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4) which would also benefit lesser sandhill crane. These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72 would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities described in Table 12-4-32.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 132 acres of roosting and foraging habitat (57 acres of permanent loss, 75 acres of temporary loss) and 14,743 acres of foraging habitat (13,879 acres of permanent loss, 864 acres of temporary loss) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 10,461 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no crane roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to construction activities.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat and potential direct mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration*, guided by biological goals and objectives for the species and by AMM1–AMM7 and *AMM20 Greater Sandhill Crane*, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-72, which would be available to compensate for loss of medium- to very high-value foraging habitat, the effects of habitat loss and potential mortality on lesser sandhill crane would not be adverse under Alternative 4.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, Alternative 4 would remove 91 acres of permanent and temporary roosting and foraging habitat (16 acres of permanent loss, 75 acres of temporary loss) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 91 acres). In addition, 6,179 acres of foraging habitat would be removed or converted in the near-term (CM1, 2,567 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 4,760 acres would be medium- to very high-value habitat (CM1, 2,098 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 91 acres of lesser sandhill crane roosting habitat should be restored/created and 91 acres should be protected to compensate for the CM1 losses of lesser sandhill crane permanent and temporary roosting and foraging habitat. In addition, 2,098 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 91 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4) which would also benefit lesser sandhill crane. These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of sandhill crane wintering habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on lesser sandhill crane habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72 would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities. Considering the conservation actions described above, AMM1–AMM7. and AMM20, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, Alternative 4 would have a less-than-significant impact on lesser sandhill cranes. No mitigation would be required.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 132 acres of roosting and foraging habitat (57 acres of permanent loss, 75 acres of temporary loss) and 14,743 acres of foraging habitat (13,879 acres of permanent loss, 864 acres of temporary loss) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 10,461 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no crane roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to construction activities.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on greater sandhill crane habitat from Alternative 4 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Considering Alternative 4's protection and restoration provisions, in addition to Mitigation Measure BIO-72, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on lesser sandhill crane.

Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

DWR must compensate for the loss of lesser sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts, to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging value categories are listed in Table 12-4-32. Foraging habitat conservation must occur within 10 kilometers of traditional sandhill crane roost sites and the location of protected habitat or conservation easements must be preapproved by CDFW.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4 facilities, as described below. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines was estimated for the BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

The transmission line footprint for Alternative 4 was changed substantially from the BDCP to reduce potential risk of greater sandhill crane collisions. The following changes also reduce potential risk of lesser sandhill crane collisions:

Alternative 4 substantially reduced the length of permanent and temporary transmission lines as compared to the BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4, no permanent transmission lines would be constructed within the greater sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4 transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by both greater and lesser sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4 as compared to the BDCP.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. In addition, after the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4 meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would substantially reduce potential collisions of lesser sandhill cranes with transmission lines. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters will be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Effects: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4 implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4 would not result in an adverse effect on lesser sandhill crane.

***CEQA Conclusion*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4 implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4 would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of Plan Implementation on Lesser Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see Appendix 11F, *Substantive BDCP Revisions*). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4-30). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding" (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on lesser sandhill crane as they primarily forage on cultivated crops and invertebrates. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect lesser sandhill crane via uptake in lower trophic levels (BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz

2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

***CEQA Conclusion*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat, there would not be an adverse effect on lesser sandhill crane.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of A*MM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in lesser sandhill crane would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on lesser sandhill crane.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 4 would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-4-33. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit least Bell's vireo and yellow warbler (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM7).
- Maintain and enhance structural heterogeneity (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation (Objective VFRNC2.2, associated with CM7).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-33. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 4 (acres)[a]

		Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	Habitat Type	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Migratory and breeding	30	30	20	20	NA	NA
Total Impacts CM1		**30**	**30**	**20**	**20**		
CM2–CM18	Migratory and breeding	382	656	88	109	48–85	148
Total Impacts CM2–CM18		**382**	**656**	**88**	**109**	**48–85**	**148**
TOTAL IMPACTS		**412**	**686**	**108**	**129**	**48–85**	**148**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 815 acres of modeled habitat (686 acres of permanent loss and 129 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-4-33). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 50 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-4-33). Of the 50 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 30 acres would be a permanent loss and 20 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of the construction of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from CM1 would occur in the central delta in CZs 3, 4, 5, 6, and 8. Permanent habitat loss would occur from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites.

Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least four years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancements would permanently remove approximately 83 acres and temporarily remove 88 acres of modeled least Bell's vireo and yellow warbler habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled least Bell's vireo and yellow warbler habitat.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 28 acres and temporarily remove 21 acres of modeled least Bell's vireo and yellow warbler habitat. Based on the riparian habitat restoration assumptions, a minimum of 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions.

The actual number of acres of valley/foothill riparian habitat that CM4 and CM5 would restore may differ from these estimates, depending on how closely the actual outcome of tidal habitat restoration approximates the assumed outcome. However, riparian restoration from CM4 and CM5 would increase the extent of least Bell's vireo and yellow warbler habitat within the study area once the restored riparian vegetation has developed habitat functions for these species.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat over the term of the BDCP. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the study area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the study area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Nesting of least Bell's vireo and yellow warbler has not been confirmed in the study area. Although there have been recent occurrences of least Bell's vireo in the Yolo Bypass and of both least Bell's vireo and yellow warbler at the San Joaquin River National Wildlife Refuge, the reestablishment of a breeding population of either species is unlikely over the term of the project (14 years). If present in the study area, construction-related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 520 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 50 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 50 acres of valley/foothill riparian habitat should be restored/created and 50 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in Chapter 3, *Conservation Strategy*, of the BDCP). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests were detected and avoided. Mitigation Measure BIO-75 would be available to address adverse effects on nesting yellow warblers.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 815 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo, and the effect of habitat loss on yellow warbler under Alternative 4 would not be adverse. The yellow warbler is not a species that is covered under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Alternative 4 would remove 520 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 50 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5], 470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 50 acres of valley/foothill riparian habitat should be restored/created and 50 acres should be protected to mitigate the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of tidal natural communities, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on least Bell's vireo and yellow warbler habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, temporal losses of potential habitat as a result of BDCP actions would not be expected to have an adverse population-level effect on either species.

The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting yellow warblers to a less-than-significant impact, should they become established in the study area. Considering the conservation actions described above, and AMM1–AMM7 AMM 22, and Mitigation Measure BIO-75, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 4 would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 815 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Therefore, there would be a time-lag before the restored habitat would benefit either species. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the impact of habitat loss and potential mortality on least Bell's vireo and the impact of habitat loss on yellow warbler under Alternative 4 would be less than significant. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect nesting yellow warblers, for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce this potential impact on nesting yellow warblers, if present in the study area, to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.
- A qualified wildlife biologist with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors, and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.
- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects: Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 4 implementation would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 4 would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*, of the BDCP). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that the transmission lines, poles, and towers are designed to avoid sensitive terrestrial habitats (including riparian) to the maximum extent feasible, which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of Plan Implementation on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions*), although there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least Bell's vireo and yellow warbler.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least Bell's vireo and yellow warbler from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting yellow warblers.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential adverse effects of methylmercury on least Bell's vireo and yellow warbler.

***CEQA Conclusion*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on least Bell's vireo and yellow warber with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. With the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than signifnicant.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Sites-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and significant impacts on least Bell's vireo and yellow warbler.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–85 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 2. No adverse effects of increased inundation frequency on least Bell's vireo, yellow warbler, or their habitat would be expected, because riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration for CM5, construction of setback levees could result in periodic inundation of up to 148 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 7. Inundation of restored floodplains would not be expected to affect least Bell's vireo, yellow warbler, or their habitat because the breeding period is outside the period when floodplains would likely be inundated. Additionally, periodic inundation of floodplains would be expected to restore a more natural flood regime in support of riparian vegetation types that support least Bell's vireo and yellow warbler habitat. The overall effect of seasonal inundation in existing riparian natural communities would be beneficial, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would not result in an adverse effect on least Bell's vireo or yellow warbler because inundation would occur primarily during the nonbreeding season and would promote a more natural flood regime in support of habitat for these species. The effect would be beneficial.

***CEQA Conclusion*:** Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic effects of inundation would have a less-than-significant impact on least Bell's vireo or yellow warbler because inundation would occur during the nonbreeding season and would not be expected to adversely modify habitat or result in direct mortality of either species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation in existing riparian natural communities would be beneficial for least Bell's vireo and yellow warbler.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects on Suisun song sparrow and saltmarsh common yellowthroat is based on primary breeding habitat and secondary habitat. Suisun song sparrow and saltmarsh common yellowthroat primary habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the study area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and value forage.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-4-34. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the Suisun song sparrow and the saltmarsh common yellowthroat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, impacts on Suisun song sparrow and saltmarsh common yellowthroat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-34. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1							
CM2–CM18	Primary	54	55	0	0	0	0
	Secondary	1,098	3,633	0	0	0	0
Total Impacts CM2–CM18		**1,152**	**3,633**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,152**	**3,688**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Alternative 4 conservation measures would result in the permanent loss of up to 3,510 acres of Suisun song sparrow and saltmarsh common yellowthroat habitat, which would include the conversion of 55 acres of primary habitat to secondary low marsh, and the conversion of 123 acres of secondary habitat to middle or high marsh (Table 12-4-34). The only conservation measure that would affect modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would permanently remove approximately 3,510 acres of modeled secondary Suisun song sparrow and saltmarsh common yellowthroat habitat from CZ 11 (Table 12-4-34). In addition, 55 acres of primary habitat would be converted to secondary low marsh, and 123 acres of secondary habitat would be converted to middle or high marsh. Most areas proposed for removal would be managed wetlands that serve as relatively marginal habitat for Suisun song sparrow and saltmarsh common yellowthroat, which primarily use brackish tidal wetlands. Approximately 2% of primary habitat for these species would be converted to foraging habitat. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland natural community in CZ 11, which would be expected to support Suisun song sparrow and saltmarsh common yellowthroat habitat. It is expected that restoring tidal wetland communities that are self-sustaining and not reliant on ongoing management actions necessary to maintain the existing managed wetland habitats would better ensure the long-term viability of these populations. Furthermore, effects of tidal habitat restoration on sparrow and yellowthroat abundance and distribution would be monitored, and the restoration of tidal habitat would be sequenced and located in a manner that minimizes effects on occupied habitats until functional habitats were restored (see Chapter 3, Section 3.4.4, *Conservation Measure 4 Tidal Natural Communities Restoration*, and Section 3.6, *Adaptive Management and Monitoring Program*, of the BDCP).

- *CM11 Natural Communities Enhancement and Management:* Control of nonnative Suisun song sparrow and saltmarsh common yellowthroat predators, if deemed necessary, would be expected to reduce predation loss of nests and, consequently, increase and maintain the abundance of Suisun song sparrow and saltmarsh common yellowthroat in restored tidal habitats over the term of the BDCP. Habitat management- and enhancement-related activities could disturb Suisun song sparrow or saltmarsh common yellowthroat nests if they are located near work sites. The potential for these activities to have an adverse effect on Suisun song sparrow would be avoided and minimized through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. A variety of *CM11 Natural Communities Enhancement and Management* habitat management actions that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of Suisun song sparrow and saltmarsh common yellowthroat habitat in CZ 11. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available species' habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect Suisun song sparrow and saltmarsh common yellowthroat use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Construction-related activities could result in nest destruction or disturbance resulting in mortality of eggs and nestlings if restoration activities took place within the nesting period for these species. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize these potential effects on Suisun song sparrow. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. Grading, filling, contouring, and other initial ground-disturbing operations during restoration activities could temporarily fragment existing modeled tidal brackish emergent wetland habitat for Suisun song sparrow and saltmarsh common yellowthroat which could temporarily reduce the extent and functions of the affected habitat. These temporary effects would be minimized through sequencing of restoration activities and through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Under Alternative 4, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to compensate for the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the study area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in Chapter 3, *Conservation Strategy*, of the BDCP) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (see Chapter 3, *Conservation Strategy*, of the BDCP) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address adverse effects of construction activities on nesting saltmarsh common yellowthroat.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 4 as a whole would result in the permanent loss of 3,510 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickelweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Suisun song sparrow and saltmarsh common yellowthroat habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and with the incorporation of additional measures in the biological goals and objectives, guided by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on Suisun song sparrow would not be adverse, and the effects of habitat loss and conversion on saltmarsh common yellowthroat would not be adverse under Alternative 4. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, for the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Under Alternative 4, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to mitigate the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the study area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3, *Conservation Strategy*) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce the impact of construction activities on nesting saltmarsh common yellowthroat to a less-than-significant level.

In the absence of other conservation actions, the effects on Suisun song sparrow and saltmarsh common yellowthroat would represent an adverse effect as a result of habitat modification and potential mortality of special-status species. Because the number of acres required to meet the typical mitigation ratio described above would be only 3,590 acres of restored/created tidal natural communities, the 6,000 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for Suisun song sparrow, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 4 as a whole would result in the permanent loss of 3,510 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickelweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The saltmarsh common yellowthroat is not a covered species under the BDCP. Although preconstruction surveys for Suisun song sparrow may detect nesting saltmarsh common yellowthroat, for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would reduce this potential impact on nesting saltmarsh common yellowthroat to a less-than-significant level.

Considering Alternative 4's restoration provisions, which would replace low-value secondary habitat with high-value tidal brackish emergent habitat, including both foraging and primary habitat, and provide upland refugia for Suisun song sparrow and saltmarsh common yellowthroat, the acreages of restoration would be sufficient to mitigate habitats lost to construction and restoration activities. Loss of habitat or direct mortality through implementation of Alternative 4, with the implementation of AMM1–AMM7, AMM22, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-81: Indirect Effects of Plan Implementation on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Indirect Construction-Related Effects: If Suisun song sparrow or saltmarsh common yellowthroat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Suisun song sparrow and saltmarsh common yellowthroat habitat adjacent to restoration work areas could be affected by such disturbances, which could temporarily result in diminished use of habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect either species. If construction occurred during the nesting season, these indirect effects could result in the loss or abandonment of nests and mortality of any eggs and/or nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of Suisun song sparrow and saltmarsh common yellowthroat by requiring preconstruction surveys and, if nests are present, the establishment of a no-disturbance buffer within 250 feet of a nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Salinity: Water conveyance facilities operations would have an effect on salinity gradients in Suisun Marsh; however, these effects cannot be reasonably disaggregated from effects resulting from tidal habitat restoration. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water conveyance facilities operations and operations of salinity control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more saline environments, which should have a beneficial effect on Suisun song sparrow and saltmarsh common yellowthroat because their historical natural Suisun Marsh habitat is brackish tidal marsh. However, the degree to which salinity changes in all tidal channels and sloughs in and around Suisun Marsh would be highly variable.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Although tidal habitat restoration might increase methylation of mercury export to other habitats, restoration is unlikely to significantly increase the exposure of Suisun song sparrow or saltmarsh common yellowthroat to methylmercury, as they currently reside in tidal marshes where elevated methylmercury levels exist. Robinson et al. (2011) found toxic levels of methylmercury levels in song sparrow populations from southern San Francisco Bay, although populations near Suisun Marsh (i.e., San Pablo and Simas Creeks) were much lower. The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. The Suisun Marsh Plan anticipates that restored tidal wetlands would generate less methylmercury than the existing managed wetlands to be restored (Bureau of Reclamation et al. 2010).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. Where restoration design and adaptive management cannot fully address the high potential for methylmercury while also meeting restoration objectives, alternate restoration areas would be considered on a project-specific basis. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Suisun song sparrow and saltmarsh common yellowthroat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Suisun song sparrow and saltmarsh common yellowthroat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Suisun song sparrow and saltmarsh common yellowthroat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances would not have an adverse effect on Suisun song sparrow with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects of noise and visual disturbance on saltmarsh common yellowthroat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills, and ensure that measures were in place to prevent runoff from the construction area and to avoid adverse effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration would be expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Tidal habitat restoration is unlikely to have a substantial impact on Suisun song sparrow and saltmarsh common yellowthroat through increased exposure to methylmercury, as these species currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*.

Changes in salinity gradients would be expected to have a beneficial impact on Suisun song sparrow and saltmarsh common yellowthroat through the establishment of tidal marsh similar to historic conditions. The implementation of tidal natural communities restoration (CM4) is unlikely to substantially increase the exposure of Suisun song sparrow or saltmarsh common yellowthroat to methylmercury, as they currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With implementation of these avoidance and minimization measures, Mitigation Measure BIO-75, and *CM12 Methylmercury Management*, indirect effects of Alternative 4 implementation would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the study area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the study area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the study area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 4 would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-4-35. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the Swainson's hawk (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM11).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Conserve at least 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat (Objective SH1.1, associated with CM3 and CM11).
- Protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3 and CM11).
- Of the at least 42,275 acres of cultivated lands protected as Swainson's hawk foraging habitat under Objective SH1.2, up to 1,500 acres can occur in CZs 5 and 6, and must have land surface elevations greater than −1 foot NAVD88 (Objective SH1.3, associated with CM3).
- Protect at least 10,750 acres of grassland, vernal pool, and alkali seasonal wetland as Swainson's hawk foraging habitat (Objective SH1.4, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM18 Swainson's Hawk* to minimize potential effects, impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-35. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	16	16	10	10	NA	NA
	Foraging	3,238	3,238	1,052	1,052	NA	NA
Total Impacts CM1		**3,254**	**3,254**	**1,062**	**1,062**		
CM2–CM18	Nesting	252	412	54	85	41–70	189
	Foraging	8,903	48,511	504	1,540	3,025–6,635	8,008
Total Impacts CM2-CM18		**9,155**	**48,923**	**558**	**1,625**	**3,066–6,705**	**8,197**
Total Nesting		**268**	**428**	**64**	**95**		
Total Foraging		**12,141**	**51,749**	**1,556**	**2,592**		
TOTAL IMPACTS		**12,409**	**52,177**	**1,620**	**2,687**	**3,066–6,705**	**8,197**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 54,864 acres of modeled habitat (523 acres of nesting habitat and 54,341 acres of foraging habitat) for Swainson's hawk (Table 12-4-35). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 water conveyance facilities would result in the combined permanent and temporary loss of up to 26 acres of Swainson's hawk nesting habitat (16 acres of permanent loss habitat and 10 acres of temporary loss). In addition, 4,290 acres of foraging habitat would be removed (3,238 acres of permanent loss, 1,052 acres of temporary loss; Table 12-4-35). Activities that would impact modeled Swainson's hawk habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are at least 12 occurrences of nesting Swainson's hawk that overlap with the construction footprint of CM1, primarily from the construction of intakes 2, 3, and 5, and the construction footprint for the permanent and temporary transmission lines. The implementation of *AMM18 Swainson's Hawk* would minimize the effects of construction on nesting Swainson's hawks if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Impacts on foraging habitat would occur throughout the central Delta in CZs 3-6, and CZ 8. Permanent foraging habitat impacts would include 849 acres of very high-value habitat (Table 12-4-36). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10–14 years of Alternative 4 implementation.

Table 12-4-36. Acres of Impacted Foraging Habitat by Value Classes for Swainson's Hawk

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	CM1 Permanent (temporary)	CM2-18 permanent (temporary)
Very high	Alfalfa hay	849 (128)	13,898 (432)
Moderate	Irrigated pasture, other hay crops, tomatoes, grain crops (wheat, barley, oats), fallow fields	745 (350)	15,136 (477)
Low	Other irrigated field and truck crops, dry pasture, grasslands, alkali seasonal wetlands, vernal pool complex, sudan	668 (234)	10,535 (349)
Very low	Safflower, sunflower, corn, grain sorghum, managed wetlands	977 (340)	8,943 (281)

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 133 acres of nesting habitat (79 acres of permanent loss, 54 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,500 acres of foraging habitat would be removed (996 acres of permanent loss, 554 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the

Sacramento Weir would also remove Swainson's hawk habitat. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 295 acres of Swainson's hawk nesting habitat and 37,359 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. Impacts on foraging habitat from CM4 would consist of 10,757 acres of very high-value (alfalfa), 11,707 acres of moderate-value, and 7,973 acres of low-value habitat (See Table 12-4-36 for land cover types classified by habitat value). Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. However, the conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM4, suggesting that numerous nest sites could be directly affected by inundation from tidal restoration activities.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 69 acres of Swainson's hawk nesting habitat (38 acres of permanent loss, 31 acres of temporary loss) and 2,856 acres of foraging habitat (1,820 acres of permanent loss, 1,036 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 953 acres of Swainson's hawk foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of Swainson's hawk agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of Swainson's hawk foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 1,440 acres of Swainson's hawk foraging habitat in CZ 2 and CZ 4. Small patches of riparian vegetation that support Swainson's hawk nesting habitat may develop along the margins of restored nontidal marsh if appropriate site conditions are present.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of Swainson's hawk grassland foraging habitat would be lost from the construction of trails and facilities.

- CM18 Conservation Hatcheries: Implementation of CM18 would remove up to 35 acres of Swainson's hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

- Permanent and temporary nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly (within 10-14 years of Alternative 4 implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 4 would remove 332 acres (268 permanent, 64 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 26 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 13,697 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 4,290 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 26 acres of nesting habitat should be restored/created and 26 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 4,290 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (five gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 4 would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 523 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and 54,341 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1–4, 7–9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Swainson's hawk habitat and potential direct mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities, the effects of habitat loss and potential mortality on Swainson's hawk under Alternative 4 would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 4 would remove 332 acres (268 permanent, 64 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 26 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 13,697 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 4,290 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 26 acres of nesting habitat should be restored/created and 26 acres should be protected to mitigate the CM1 losses of Swainson's hawk nesting habitat. In addition, 4,290 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small

but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk within the study area until restored riparian habitat is sufficiently developed.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that are incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 4 would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Therefore, Alternative 4 would have a less-than-significant impact on Swainson's hawks. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 523 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and 54,341 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration,* and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian

restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1-4, 7- 9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on Swainson's hawk habitat from Alterative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Swainson's hawk.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. This species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the study area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

***NEPA Effects*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

***CEQA Conclusion*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of Plan Implementation on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. These construction activities would include water conveyance construction, tidal restoration activities, floodplain restoration, and Fremont Weir/Yolo Bypass Enhancements. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with BDCP actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 3,066–6,706 acres of modeled Swainson's hawk habitat (consisting of approximately 41–70 acres of nesting habitat and 3,025–6,635 acres of foraging habitat; Table 12-4-35). However, project-associated inundation of areas that would not otherwise have been inundated would be expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the project-related inundation area already inundates in the bypass. Therefore, habitat conditions in the bypass would not be expected to change substantially as a result of Yolo Bypass operations. However, increased duration of inundation during years of Fremont Weir operation, may delay the period for which foraging habitat is available to Swainson's hawks by up to several weeks.

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 8,197 acres of modeled Swainson's hawk habitat (Table 12-4-35), consisting of 189 acres of nesting and 8,008 acres of foraging habitat. Floodplain restoration would be expected to restore a more natural flood regime and sustain riparian vegetation types that support regeneration of Swainson's hawk nesting habitat. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more). Foraging habitat that is inundated after Swainson's hawks arrive in the Central Valley in mid-March could result in a periodic loss of available foraging habitat due to the reduction in available prey. Inundated habitats would be expected to recover following draw-down and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic and short term effect that is unlikely to affect Swainson's hawk distribution and abundance, or foraging use of the study area.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would have a less-than-significant impact on Swainson's hawk.

Tricolored Blackbird

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on tricolored blackbird. The habitat model used to assess effects for tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass, along the southwestern perimeter of the study area, and in the southeast corner of the study area near the San Joaquin River, breeding colonies are uncommon in the study area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the study area. The nesting component consists of nontidal freshwater perennial emergent marsh, and valley foothill riparian natural communities that occur within 5 miles of breeding colonies documented between 1998 and 2012. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the study area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of tricolored blackbird modeled breeding and nonbreeding habitat as indicated in Table 12-4-37. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the tricolored blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and manage at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11. (Objective TRBL1.1).
- Protect at least 26,300 acres of moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, 50% of which is of high or very high value (Objective TRBL1.2).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. At least 1,000 acres of this protected breeding-foraging habitat will be within 5 miles of the 50 acres of nesting habitat protected under Objective TRBL1.1 (Objective TRBL1.3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-37. Changes to Tricolored Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type		Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	Nesting	15	15	4	4	NA	NA
	Breeding	Foraging - cultivated	1,389	1,389	172	172	NA	NA
	Breeding	Foraging- noncultivated	290	290	105	105	NA	NA
	Nonbreeding	Roosting	9	9	21	21	NA	NA
	Nonbreeding	Foraging - cultivated	1,047	1,047	487	487	NA	NA
	Nonbreeding	Foraging - noncultivated	179	179	53	53	NA	NA
Total Impacts CM1			**2,929**	**2,929**	**842**	**842**		
CM2–CM18	Breeding	Nesting	13	72	75	77	11-26	30
	Breeding	Foraging- cultivated	1,657	9,525	84	359	1,837-2,598	2,124
	Breeding	Foraging noncultivated	704	1,991	155	184	600-1,689	355
	Nonbreeding	Roosting	570	1,642	0	1	0-4	29
	Nonbreeding	Foraging - cultivated	3,747	23,955	54	420	222-1,057	2,506
	Nonbreeding	Foraging - noncultivated	459	1,341	0	3	42-191	158
Total Impacts CM2–CM18			**7,150**	**38,526**	**368**	**1,044**	**2,711**	**5,766**
Total Breeding			**4,068**	**13,282**	**595**	**901**	**2,447-4,312**	**2,509**
Total Nonbreeding			**6,011**	**28,173**	**615**	**985**	**263-1,252**	**2,694**
TOTAL IMPACTS			**10,079**	**41,455**	**1,210**	**1,886**	**2,711**	**5,766**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 43,341 acres of modeled habitat (14,183 acres of breeding habitat and up to 29,158 acres of nonbreeding habitat) for tricolored blackbird (Table 12-4-37). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent loss of 1,694 acres of tricolored blackbird breeding habitat (15 acres nesting habitat, 1,389 acres of cultivated lands, and 290 acres of noncultivated lands suitable for foraging) and 1,235 acres of nonbreeding habitat (9 acres roosting habitat, 1,047 acres of cultivated lands, and 179 acres of noncultivated lands suitable for foraging, Table 12-4-37). Approximately 796 of the acres permanently impacted would be lost as reusable tunnel material storage areas, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. In addition, CM1 would result in the temporary removal of 281 acres of breeding habitat (4 acres nesting habitat, 172 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 561 acres of nonbreeding habitat (21 acres roosting habitat, 487 acres of cultivated lands, and 53 acres of noncultivated lands suitable for foraging, Table 12-4-37).

  Most of the habitat that would be lost is located in the central Delta, from CZs 3-6 and CZ 8. There are no occurrences of tricolored blackbird that overlap with the construction footprint for CM1. However, records exist throughout the study area. *AMM21 Tricolored Blackbird* would minimize the effects of construction on nesting tricolored blackbirds if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the near-term timeframe of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would permanent loss of 595 acres of tricolored blackbird breeding habitat (13 acres nesting habitat, 477 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 8 acres of nonbreeding habitat (consisting entirely of roosting habitat). In addition, CM2 construction would result in the temporary removal of 314 acres of breeding habitat (75 acres nesting habitat, 84 acres of cultivated lands, and 155 acres of noncultivated lands suitable for foraging) and 54 acres of nonbreeding habitat (consisting entirely of cultivated lands). The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 3,937 acres of tricolored blackbird breeding habitat (21 acres of nesting, 2,814 acres of cultivated lands, and 1,102 acres of noncultivated lands suitable for foraging) and 10,794 acres of nonbreeding habitat (1,633 acres of roosting, 18,489 acres of cultivated lands, and 672 acres of noncultivated lands suitable for foraging). An estimated 13,692 acres of the 28,424 acres to be permanently lost would be expected to convert to tidal emergent wetland communities that could provide nonbreeding season roosting habitat for tricolored blackbirds, depending on future vegetation density and composition. Conversion would result in the loss of an estimated 4,316 acres of tricolored blackbird breeding habitat (34 acres of nesting habitat; plus 3,635 acres of cultivated lands and 647 acres of noncultivated habitats suitable for foraging) and 9,375 acres of nonbreeding habitat (8,716 acres of cultivated lands and 659 acres of noncultivated habitats suitable for foraging). These habitat losses and conversions would occur in CZs 1, 2, 4, 5, 6, 7, 8, and 11. Although considered to be a permanent loss, due to the uncertainty of the quantity of restored suitable habitat, any areas that develop into riparian scrub-shrub could provide suitable nesting and roosting habitat for tricolored blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction and riparian restoration associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent removal of up to 554 acres of tricolored blackbird breeding habitat (4 acres of nesting habitat, 503 acres of cultivated lands, and 47 acres of noncultivated habitats suitable for foraging) and 656 acres of nonbreeding habitat (1 acre of roosting habitat, 652 acres of cultivated lands, and 3 acres of noncultivated habitats suitable for foraging) in CZ 7. Patches of riparian scrub associated with the restoration of approximately 1,000 acres of valley/foothill riparian habitat managed as early- to mid-successional habitats (as a component of CM5) could provide suitable nesting, roosting or foraging habitat for tricolored blackbird once these restored habitats have developed habitat functions for the species.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland would result in the permanent removal of 1,521 acres of tricolored breeding habitat and 210 acres of nonbreeding habitat. Grassland restoration would be implemented on cultivated lands and would therefore result in the conversion of tricolored blackbird cultivated foraging habitat to high-value grassland foraging habitat in CZs 2, 4, and 5.

- *CM10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 568 acres of tricolored blackbird breeding habitat and 945 acres of nonbreeding habitat (all cultivated lands suitable for foraging). About two-thirds of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide roosting habitat for tricolored blackbird depending on vegetation density and composition.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. Surveys would be conducted under *AMM21 Tricolored Blackbird* to ensure that areas identified for recreational development did not contain active breeding or foraging tricolored blackbirds. However, approximately 43.5 acres of breeding habitat and 6.5 acres of nonbreeding habitat (all grassland suitable for foraging) would be lost as a result of construction of trails and facilities. Impacts from recreational-related facilities that would occur within the first 10 years of Alternative 4 implementation would include a loss of 13 acres of breeding habitat.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of tricolored blackbird grassland foraging habitat in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 300 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* in Appendix 3B, *Environmental Commitments, AMMs, and CMs.*

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 4,663 acres of breeding habitat (28 acres of nesting, 1,947 acres of cultivated lands, and 994 acres of noncultivated lands suitable for foraging) and 6,626 acres of nonbreeding habitat (579 acres of roosting, 4,794 acres of cultivated lands, and 638 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities(CM1, 1,975 acres of breeding, 1,796 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 1:1 protection for the loss of cultivated lands, and 2:1 protection for loss of noncultivated lands suitable for foraging.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 19 acres of restoration and 19 acres of protection of nesting habitat, 30 acres of restoration and 30 acres of protection of roosting habitat, 3,095 acres of protection of cultivated lands that provide foraging habitat, and 627 acres of protection of noncultivated lands suitable for foraging. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 5,542 acres of cultivated lands, and 1,318 acres of noncultivated lands suitable for foraging. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 5,542 acres of cultivated lands that provide foraging habitat, and 2,636 acres of noncultivated lands using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird habitat (from the implementation of all conservation measures) that would be required using the typical ratios above would be 108 acres of restoration and 108 acres of protection for nesting habitat, 611 acres of restoration and 611 acres of protection for roosting habitat, 8,793 acres of protection of cultivated foraging habitat, and 3,952 acres of noncultivated lands that provide foraging habitat.

The BDCP has committed to near-term goals of protecting 25 acres of nontidal marsh, 750 acres of valley/foothill riparian, 2,000 acres of grassland, 400 acres of vernal pool complex, 120 acres of alkali seasonal wetland complex, 4,800 acres of managed wetland, 15,400 acres of non-rice cultivated lands, and 900 acres of rice (or rice-equivalent wetlands such as nontidal marsh). In addition, the restoration of 800 acres of valley/foothill riparian, 1,140 acres of grassland, 8,850 acres of tidal freshwater emergent wetlands, and 2,000 acres of tidal brackish emergent wetlands would be initiated in the near-term timeframe (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-4-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the study area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (see Chapter 5, Section 5.6.12.2, *Beneficial Effects*, of the BDCP). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

Table 12-4-38. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands, unsprayed alfalfa, unsprayed sunflower, unsprayed mixed alfalfa	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies	Corn, sunflower, alfalfa and mixed alfalfa, mixed pasture, native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grasses, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots, organic rice	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production, organic rice
Low	Wheat, mixed grain and hay crops, farmsteads, non-irrigated mixed grain and hay, rice	Wheat, oats, mixed grain and hay, farmsteads, non-irrigated mixed grain and hay, and non-irrigated misc. grain and hay

[a] Generally March through August; occasional breeding in fall (September through November).

The Plan estimates that modeled roosting habitat in the study area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (see Chapter 5, Section 5.6.12.2, *Beneficial Effects*, of the BDCP). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and foraging habitat. With the protection and restoration acres described above, and the implementation of AMM1–AMM7 and AMM21, potential impacts of Plan implementation in the near-term time period would not result in an adverse effect on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (see Chapter 5, *Effects Analysis*, of the BDCP). Alternative 4 as a whole would result in the permanent loss of and temporary effects on 14,183 acres of breeding habitat and 29,158 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (9% of the total breeding habitat in the study area and 11% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, species specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-4-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of

these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The losses of tricolored blackbird habitat and potential direct mortality of a special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM5, CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7 and *AMM21 Tricolored Blackbird*, which would be in place during all project activities, the effects of habitat loss or potential mortality on tricolored blackbird under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 4,663 acres of breeding habitat (28 acres of nesting, 1,947 acres of cultivated lands, and 994 acres of noncultivated lands suitable for foraging) and 6,626 acres of nonbreeding habitat (579 acres of roosting, 4,794 acres of cultivated lands, and 638 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,975 acres of breeding, 1,796 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 1:1 protection for the loss of cultivated lands, and 2:1 protection for loss of noncultivated lands suitable for foraging.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 19 acres of restoration and 19 acres of protection of nesting habitat, 30 acres of restoration and 30 acres of protection of roosting habitat, 3,095 acres of protection of cultivated lands that provide foraging habitat, and 627 acres of protection of noncultivated lands suitable for foraging. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 5,542 acres of cultivated lands, and 1,318 acres of noncultivated lands suitable for foraging. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 5,542 acres of cultivated lands that provide foraging habitat, and 2,636 acres of noncultivated lands using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird habitat (from the implementation of all conservation measures) that would be required using the typical ratios above would be 108 acres of restoration and 108 acres of protection for nesting habitat, 611 acres of restoration and 611 acres of protection for roosting habitat, 8,793 acres of protection of cultivated foraging habitat, and 3,952 acres of noncultivated lands that provide foraging habitat.

The BDCP has committed to near-term goals of protecting 25 acres of nontidal marsh, 750 acres of valley/foothill riparian, 2,000 acres of grassland, 400 acres of vernal pool complex, 120 acres of alkali seasonal wetland complex, 4,800 acres of managed wetland, 15,400 acres of non-rice cultivated lands, and 900 acres of rice (or rice-equivalent wetlands such as nontidal marsh). In addition, the restoration of 800 acres of valley/foothill riparian, 1,140 acres of grassland, 8,850 acres of tidal freshwater emergent wetlands, and 2,000 acres of tidal brackish emergent wetlands would be initiated in the near-term timeframe (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-4-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the study area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (see Chapter 5, Section 5.6.12.2, *Beneficial Effects*, of the BDCP). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the study area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (see Chapter 5, Section 5.6.12.2, *Beneficial Effects*, of the BDCP). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on tricolored blackbird habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. With the protection and restoration acres described above, and the implementation of AMM1–AMM7 and AMM21, potential impacts of Plan implementation in the near-term time period would result in a less-than-significant impact on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (see Chapter 5, *Effects Analysis*, of the BDCP). Alternative 4 as a whole would result in the permanent loss of and temporary effects on 14,183 acres of breeding habitat and 29,158 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (9% of the total breeding habitat in the study area and 11% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*).

Species specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-4-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of

these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on tricolored blackbird habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 4 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area. Although migratory movements and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds. The existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on tricolored blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily in winter during daily flights between roosting and foraging sites and during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 4 would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of Plan Implementation on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 300 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony or roost site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration).

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. Furthermore, the Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands, potentially reducing the overall risk. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community and floodplain restoration could indirectly affect tricolored blackbird, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. Where restoration design and adaptive management cannot fully address the high potential for methylmercury production while also meeting restoration objectives, alternate restoration areas would be considered on a project-specific basis. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which

forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1–AMM7, AMM21, AMM27, and CM12 in place, the indirect effects of Alternative 4 implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 2,447–4,312 acres of breeding habitat and 263–1,252 acres of nonbreeding habitat (Table 12-4-37). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 2,509 acres of breeding habitat (30 acres of nesting, 2,124 acres of cultivated lands, 355 acres of noncultivated lands suitable for foraging) and 2,694 acres of nonbreeding habitat(29 acres of roosting, 2,506 acres of cultivated lands, 158 acres of noncultivated lands suitable for foraging; see Table 12-4-37) resulting in the temporary loss of these habitats. Tricolored blackbirds are highly nomadic during the winter and would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat. There would be no expected adverse effect on tricolored blackbird.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would not result in an adverse effect on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would have a less-than-significant impact on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

Western Burrowing Owl

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-4-39. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the western burrowing owl (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least 1,000 acres of cultivated lands in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 mile of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1, associated with CM3).
- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands and vernal pool complex in CZs 1, 8, and/or 11 to achieve no net loss of wetted acres (Objectives ASWNC1.2 and VPNC1.2, associated with CM9)
- Increase burrow availability and prey abundance and accessibility (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, VPNC2.5, GNC2.3, and GNC2.4, associated with CM11)
- Protect at least 48,600 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species and maintain and protect the small patches of important wildlife habitats associated with cultivated lands (Objectives CLNC1.1 and CLNC1.3, associated with CM3)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and *AMM23 Western Burrowing Ow*l, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-39. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	High-value	863	863	314	314	NA	NA
	Low-value	2,294	2,294	559	559	NA	NA
Total Impacts CM1		**3,157**	**3,157**	**873**	**873**		
CM2–CM18	High-value	4,487	11,570	245	328	1,390-3,303	779
	Low-value	3,527	28,506	144	971	1,522-2,927	6,162
Total Impacts CM2–CM18		**8,014**	**40,076**	**389**	**1,299**	**2,912-6,230**	**6,941**
Total High-value		**5,350**	**12,433**	**559**	**642**	**1,390-3,303**	**779**
Total Low-value		**5,821**	**30,800**	**703**	**1,530**	**1,522-2,927**	**6,162**
TOTAL IMPACTS		**11,171**	**43,233**	**1,262**	**2,172**	**2,912-6,230**	**6,941**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 45,405 acres of modeled habitat for western burrowing owl (of which 13,075 acres is of high-value and 32,330 acres is of low value, Table 12-4-39). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*. The majority of habitat loss (29,668 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 1,177 acres of acres of modeled high-value western burrowing owl habitat (863 acres of permanent loss, 314 acres of temporary loss) from CZs 3–6 and CZ 8. In addition, 2,853 acres of low-value burrowing owl habitat would be removed (2,294acres of permanent loss, 559 acres of temporary loss). The majority of high-value grassland habitat that would be removed would be in CZ 8, from the construction of the new forebay in CZ 8. There is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from facility construction and the establishment of the forebay RTM storage area could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat.

The RTM storage area overlaps with six occurrences of western burrowing owl and there are also several occurrences west of the new forebay control structure that could be indirectly affected by construction activities. The amount of storage area needed for reusable tunnel material is flexible (dependent on storage pile height and other factors) and the footprint used in the effects analysis is based on a worst case scenario. However, the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage. The implementation of *AMM6 Disposal and Reuse of Spoils* and *AMM23 Western Burrowing Owl* would require that, to the extent practicable, the reusable tunnel material storage area footprint avoided locations where active burrows are present. The footprints of a permanent transmission line and a permanent access road, both located west of the Clifton Court Forebay, overlap with an additional 8 occurrences of western burrowing owl. Preconstruction surveys would be conducted prior to any construction activities under *AMM23 Western Burrowing Owl* during the nonbreeding and the breeding season. If avoidance was not possible, passive relocation would be considered in consultation with CDFW. If owls were to be excluded from existing burrows, artificial burrows would be used if it were possible for them to be installed within 100 meters from the existing burrows on protected lands. A substantial portion of the high-value grassland protection and enhancement under *CM8 Grassland Natural Community Restoration* would be expected to occur to the west and to the south of these occurrences in CZ 8, which would provide high-value protected lands in close proximity to the disturbed habitat.

Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,127 acres of high-value western burrowing owl habitat (882 acres of permanent loss, 245 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 242 acres of low-value habitat would be removed (98 acres of permanent loss, 144 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 29,668 acres of modeled western burrowing owl habitat in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. The majority of removed or converted acres (19,739 acres) is composed of low-value habitat. However, 9,929 acres of high-value habitat would also be lost from tidal restoration actions. Tidal restoration would directly impact and fragment remaining high-value grassland habitat just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Tidal natural community restoration efforts would impact one extant record of burrowing owl just northeast of Oakley along Dutch Slough and one possibly extirpated record in Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,504 acres of modeled western burrowing owl in CZs 2, 4, and 7. This total is comprised of 2,279 acres of low-value habitat. Also, 225 acres of high-value grassland habitat would be removed (142 permanent, 83 temporary) consisting of small patches of habitat along the San Joaquin, Old, and Middle Rivers in CZ 7.

- *CM6 Channel Margin Enhancement*: Sites for channel margin enhancement would be located along levees where western burrowing owl could be present. The species is known to use often the grassland edges along canals and levees in agricultural areas. The implementation of *AMM23 Western Burrowing Owl* would reduce the potential for channel margin enhancement activities to disturb owls or affect active nests.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 11 acres of high-value burrowing owl habitat as part of tidal restoration. In addition, 960 acres of low-value habitat would be removed as a part of tidal restoration and 3,991 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Grassland restoration would primarily be implemented on agricultural lands and would result in the permanent loss of 1,676 acres (362 acres of high-value and 1,314 acres of low-value) of western burrowing owl habitat. The conversion of 1,676 acres of low-value habitat to high-value grassland, would temporarily remove available habitat but would ultimately have a beneficial effect on the western burrowing owl.

- *CM10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 159 acres of high-value and 952 acres of low-value western burrowing owl habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* into the BDCP which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value western burrowing owl habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 5,909 acres (5,350 acres permanent, 559 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,177 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 6,524 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,853 acres; *CM2-CM18*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. Using these typical ratios would indicate that 2,354 acres should be protected to compensate for the loss of high-value habitat and 2,853 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on western burrowing owl high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of high-value burrowing owl habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for the Near-Term Loss of High-Value Burrowing Owl Habitat,* would be available to address the adverse effect of high-value habitat loss in the near-term.

The compensation for the loss of low-value burrowing owl habitat from near-term impacts would be sufficient to meet the typical ratio of 1:1 protection. A proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat In addition, 1,262 acres of impacts on burrowing owl habitat would be temporary and would be restored within 1 year of the completion of construction. The management and enhancement of cultivated lands and protected grasslands including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any potential effect from the near-term loss of foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 13,075 acres of high-value habitat and 32,330 acres of low-value western burrowing owl habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western burrowing owl habitat and potential for mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, *AMM23 Western Burrowing Owl*, and with Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 5,909 acres (5,350 acres permanent, 559 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,177 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 6,524 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,853 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 2,354 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 2,853 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table

3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on western burrowing owl high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of high-value burrowing owl habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for the Near-Term Loss of High-Value Burrowing Owl Habitat*, would address the impact of high-value habitat loss in the near-term.

The compensation for the loss of low-value burrowing owl habitat from near-term impacts sufficient to meet the typical ratio of 1:1 protection. A proportion of the loss of low-value habitat would be a result of the conversion to high-value habitat. In addition, 1,262 acres of impacts on burrowing owl habitat would be temporary and would be restored within 1 year of the completion of construction. The management and enhancement of cultivated lands and protected grasslands including prey enhancement, increasing burrow availability, and reducing existing fragmentation of high-value habitat, would further compensate for any potential effect from the near-term loss of foraging habitat on western-burrowing owl.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of

these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The loss of western burrowing owl habitat and potential for mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, *AMM23 Western Burrowing Owl*, and with Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl under Alternative 4 would be less than significant.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 13,075 acres of high-value habitat and 32,330 acres of low-value western burrowing owl habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM23 Western Burrowing Owl,* and Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western burrowing owl.

Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

Because the BDCP lacks an acreage commitment for specific crop types that would be managed within the 15,400 acres of cultivated lands protected in the near-term time period, DWR will compensate for the loss of high-value burrowing owl habitat with high-value natural communities or cultivated crop types a ratio of 2:1 in the near-term time period.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given its physical and behavioral characteristics (BDCP Appendix 5.J, Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*) and new transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of Plan Implementation on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of up to 13,922 acres of modeled burrowing owl habitat (6,113 acres of high-value habitat) within 500 feet of covered activities will temporarily be made less suitable as a result of construction noise and visual disturbances adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with incorporation of *AMM23 Western Burrowing Owl* into the BDCP, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

NEPA Effects: Indirect effects on western burrowing owl as a result of Alternative 4 implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, the indirect effects from Alternative 4 implementation would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects on western burrowing owl as a result of Alternative 4 implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 4 implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,390–3,303 acres of high-value habitat and 1,522–2,927 acres of low-value habitat (Table 12-4-39).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 6,941 acres of modeled habitat (6,162 acres, of which would be low-value foraging habitat; Table 12-4-39).

Burrowing owls cannot use inundated areas for foraging or nesting, and increased inundation frequency and duration of cultivated lands and grassland habitats may affect prey populations that have insufficient time to recover following inundation events. Depending on timing, seasonal inundation of western burrowing owl habitat could result in displacement from nesting burrows or drowning of individuals. The potential for this effect is considered low because suitable burrow sites would most likely be located along setback levees, which are expected to be subject to inundation less frequently than floodplain surfaces that would be less likely to support suitable nesting burrows.

NEPA Effects: The periodically inundated habitat would not be expected to have an adverse effect on the population. The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation; therefore, the potential impact would not be adverse.

CEQA Conclusion: The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation. Therefore, periodic inundation would be expected to have a less-than-significant impact on the population.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on western yellow-billed cuckoo. The habitat model for Western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres, and migratory habitat, which includes the same plant alliances as breeding habitat without the minimum 50 acres patch size requirement.

The western yellow-billed cuckoo is uncommon in the study area at present, and the likelihood that it would be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the study area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of Western yellow-billed cuckoo modeled habitat as indicated in Table 12-4-40. Full implementation Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the western yellow-billed cuckoo (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on Western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-40. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 4 (acres)[a]

		Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	Habitat Type	NT	LLT	NT	LLT	CM2	CM5
CM1	Breeding	6	6	2	2	NA	NA
	Migratory	15	15	15	15	NA	NA
Total Impacts CM1		**21**	**21**	**17**	**17**		
CM2–CM18	Breeding	29	142	5	10	11-20	17
	Migratory	278	383	83	94	37-64	125
Total Impacts CM2–CM18		**307**	**525**	**88**	**104**	**48-84**	**142**
Total Breeding		**35**	**148**	**7**	**12**		
Total Migratory		**293**	**398**	**98**	**109**		
TOTAL IMPACTS		**328**	**546**	**105**	**121**	**48-84**	**142**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 667 acres of modeled habitat for western yellow-billed cuckoo (160 acres of breeding habitat, 507 acres of migratory habitat, Table 12-4-40). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 8 acres of breeding habitat (6 acres of permanent loss, 2 acres of temporary loss) for yellow-billed cuckoo. In addition, 30 acres of migratory habitat would be removed (15 acres of permanent loss, 15 acres of temporary loss, see Table 12-4-40). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from CM1 would occur in the central delta in CZs 3- 6, and 8. Permanent habitat loss would occur from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

There are no extant occurrences of yellow-billed cuckoo nests in the study area; however, habitat loss from the construction of CM1 facilities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the effects of construction on nesting cuckoos if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the loss of approximately 31 acres of breeding habitat (26 acres of permanent loss and 5 acres of temporary loss) and 140 acres of migratory habitat (57 acres of permanent loss and 83 acres of temporary loss) for yellow-billed cuckoo in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 4 implementation. There are no extant occurrences of yellow-billed cuckoo nesting in the study area.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 110 acres of modeled yellow-billed cuckoo breeding habitat and 310 acres of modeled migratory habitat in CZ 1, 2, 6, and 11. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove. These detections do not overlap with the hypothetical restoration areas for CM4.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 11

acres of modeled yellow-billed cuckoo breeding habitat (6 acres of permanent loss and 5 acres of temporary loss) and 27 acres of migratory habitat (16 acres of permanent loss and 11 acres of temporary loss) in CZ 7. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support western yellow-billed cuckoo habitat once the riparian vegetation has developed habitat functions for the cuckoo.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat over the term of the BDCP. With conditions favorable for its future establishment in the study area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. CM11 actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection in 2009 in DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the present of suitable habitat indicates that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Although there is minimal habitat in the Plan Area that is of appropriate width, and suitable understory to support nesting cuckoos, if western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 433 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 38 acres of modeled breeding and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 38 acres of valley/foothill riparian habitat should be restored/created and 38 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the study area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 667 acres of modeled habitat (5% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat associated with Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, the species is not an established breeder in the study area and current presence is limited to migrants. In addition, the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on western yellow-billed cuckoo under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 433 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 38 acres of modeled breeding and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 38 acres of valley/foothill riparian habitat should be restored/created and 38 acres should be protected to mitigate the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the study area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the loss of western yellow-billed cuckoo habitat associated with Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. However, the species is not an established breeder in the study area and current presence is limited to migrants. In addition, the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on western yellow-billed cuckoo under Alternative 4 would be less-than-significant.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 667 acres of modeled habitat (5% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Pla*n, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on western yellow-billed cuckoo from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species; however, considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a, minimal effect on the species.

NEPA Effects: Fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area, it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors, which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. In addition, the transmission lines that would be constructed in the vicinity of modeled western yellow-billed cuckoo habitat would be temporary and would be removed within 10-14 years of Alternative 4 implementation. Because there is low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

NEPA Effects: The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of Plan Implementation on Western Yellow-Billed Cuckoo

Construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, AMM10, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: Western yellow-billed cuckoo modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Cuckoos are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on western yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the western yellow-billed cuckoo. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on western yellow-billed cuckoo.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on western yellow-billed cuckoo from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Alternative 4 implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Indirect effects on western yellow-billed cuckoo as a result of Alternative 4 implementation could have a significant impact on the species from modification of habitat.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects as a result of Alternative 4 implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 11-20 acres of modeled western yellow-billed cuckoo breeding habitat and 37–64 acres of modeled migratory habitat. No adverse effects of increased inundation frequency on western yellow-billed cuckoo or its habitat are expected because the cuckoo breeding period is outside the period the weir would be operated. In addition, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 142 acres of modeled western yellow-billed cuckoo habitat (17 acres of breeding habitat, 125 acres of migratory habitat). Inundation of restored floodplains is not expected to affect western yellow-billed cuckoo or its habitat adversely because the cuckoo breeding period is outside the period the floodplains would likely be inundated, and periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for western yellow-billed cuckoo. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for western yellow-billed cuckoo, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Periodic effects of inundation would not have an adverse on yellow-billed cuckoo if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

White-Tailed Kite

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen et al. 1995).

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-4-41. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed Kite*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4 would also include the following biological objectives over the term of the BDCP to benefit the white-tailed kite (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM11)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-41. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	25	25	16	16	NA	NA
	Foraging	3,244	3,244	1,054	1,054	NA	NA
Total Impacts CM1		**3,269**	**3,269**	**1,070**	**1,070**		
CM2–CM18	Nesting	312	507	88	121	48–82	230
	Foraging	8,723	52,675	516	1,484	3,030–6,651	7,402
Total Impacts CM2–CM18		**9,035**	**53,182**	**604**	**1,605**	**3,078–6,733**	**7,632**
Total Nesting		**337**	**532**	**104**	**137**		
Total Foraging		**11,967**	**55,919**	**1,570**	**2,538**		
TOTAL IMPACTS		**12,304**	**56,451**	**1,674**	**2,675**	**3,078–6,733**	**7,632**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 59,126 acres of modeled habitat (669 acres of nesting habitat and 59,126 acres of foraging habitat) for white-tailed kite (Table 12-4-41). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 water conveyance facilities would result in the combined permanent and temporary loss of up to 41 acres of white-tailed kite nesting habitat (25 acres of permanent loss and 16 acres of temporary loss). In addition, 4,298 acres of foraging habitat would be removed (3,244 acres of permanent loss, 1,054 acres of temporary loss). Activities that would impact modeled white-tailed kite habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 1–3 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no occurrences of nesting white-tailed kite that overlap with the construction footprint of CM1. The implementation of *AMM39 White-Tailed Kite* would minimize the effects of construction on kites if they were to nest in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Impacts on foraging habitat would occur throughout the central Delta in CZs 3- 6, and CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,525 acres of foraging habitat would be removed (1,008 acres of permanent loss, 516 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove white-tailed kite habitat. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 383 acres of white-tailed kite nesting habitat and 41,625 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of white-tailed kite nesting habitat (42 acres of permanent loss, 33 acres of temporary loss) and 2,675 acres of foraging habitat (1,706 acres of permanent loss, 968 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 971 acres of white-tailed kite foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of white-tailed kite agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 1,440 acres of cultivated lands to nontidal marsh in CZ 2 and CZ 4. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of white-tailed kite grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-white-tailed kite foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

  Permanent and temporary white-tailed kite nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM39 White-Tailed Kite* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged white-tailed kite if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM39 White-Tailed Kite* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 4 would remove 441 acres (337 acres of permanent loss, 104 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 41 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 13,537 acres (11,967 acres of permanent loss, 1,570 acres of temporary loss) of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 4,298 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 41 acres of nesting habitat should be restored/created and 41 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 4,298 acres should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for restoration and 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. With this program in place, Alternative 4 would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 669 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 58,457 acres of foraging habitat (12% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite habitat and potential direct mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM39 White-Tailed Kite*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on white-tailed kite under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 4 would remove

441 acres (337 acres of permanent loss, 104 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 41 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 13,537 acres (11,967 acres of permanent loss, 1,570 acres of temporary loss) of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 4,298 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 41 acres of nesting habitat should be restored/created and 41 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 4,298 acres should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for restoration and 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

With this program in place, Alternative 4 would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Therefore, Alternative 4 would have a less-than-significant impact on white-tailed kite.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 669 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 58,457 acres of foraging habitat (12% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on white-tailed kite habitat from Alterative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM39 White-Tailed Kite*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of white-tailed kite. In particular, 95% of the loss of foraging habitat effects involve the conversion from one habitat type to another form of suitable foraging habitat. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on white-tailed kite.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of bird strike mortality from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on white-tailed kite.

CEQA Conclusion: The construction and presence of new transmission lines would not represent a significant impact because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of Plan Implementation on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM39 White-Tailed Kite* would require preconstruction surveys, and if detected, 200-yard no-disturbance buffers would be established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on white-tailed kite.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect white-tailed kite use of the surrounding habitat. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4 would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4 implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*), would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

CEQA Conclusion: Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4 would have a less-than-significant impact on white-tailed kite with the implementation of *AMM39 White-Tailed Kite*, and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4 implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (related to *CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 48–82 acres of modeled white-tailed kite nesting habitat and 3,030–6,651 acres of modeled white-tailed kite foraging habitat (Table 12-4-41). During inundation years, affected cultivated lands and grassland would not be available as foraging habitat until prey populations have re-inhabited inundated areas. This would result in temporary periodic reduction in availability of foraging habitat. If late-season Fremont Weir operations were to preclude the planting of some crop types, there could be a further loss of foraging habitat value if the crop type that would have been planted would provide greater foraging habitat value than the fallowed fields. No known white-tailed kite nest sites would be affected, and increased periodic flooding is not expected to cause any adverse effect on nest sites that may be within the inundation area because existing trees already withstand floods in the area, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and any nest sites would be located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to approximately 230 acres of modeled white-tailed kite nesting habitat and 7,402 acres of modeled white-tailed kite foraging habitat (Table 12-4-41). Inundation of foraging habitat could result in a periodic reduction of available foraging habitat due to the reduction in available prey. Following draw-down, inundated habitats are expected to recover and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic impact that is unlikely to affect white-tailed kite distribution and abundance, or foraging use of the study area.

Periodic inundation of floodplains (through CM2 and CM5) would be expected to restore a more natural flood regime in support of riparian vegetation types that support white-tailed kite nesting habitat. No adverse effects of inundation on white-tailed kite riparian habitat are expected because valley/foothill riparian vegetation is expected to benefit from seasonal inundation.

NEPA Effects: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would not result in an adverse effect.

CEQA Conclusion: Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would be expected to have a less-than-significant impact on white-tailed kite.

Yellow-Breasted Chat

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-4-42. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit the yellow-breasted chat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-42. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Nesting and Migratory Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	15	15	10	10	NA	NA
	Secondary	15	15	9	9	NA	NA
	Suisun Marsh/ Upper Yolo Bypass	0	0	0	0	NA	NA
Total Impacts CM1		**30**	**30**	**19**	**19**		
CM2–CM18	Primary	96	214	58	73	19-38	92
	Secondary	209	357	0	6	6-18	56
	Suisun Marsh/ Upper Yolo Bypass	76	85	29	29	23-32	0
Total Impacts CM2–CM18		**381**	**656**	**87**	**108**	**48-88**	**148**
Total Primary		**111**	**229**	**68**	**83**	**19-38**	**92**
Total Secondary		**224**	**372**	**9**	**15**	**6-18**	**56**
Total Suisun Marsh/Upper Yolo Bypass		**76**	**85**	**29**	**29**	**23-32**	**0**
TOTAL IMPACTS		**411**	**686**	**106**	**127**	**48-88**	**148**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 813 acres of modeled nesting and migratory habitat for yellow-breasted chat (686 acres of permanent loss, 127 acres of temporary loss, Table 12-4-42). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 25 acres of primary habitat (15 acres of permanent loss, 10 acres of temporary loss). In addition, 24 acres of secondary habitat would be removed (15 acres of permanent loss, 9 acres of temporary loss, Table 12-4-42). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and temporary work areas. Impacts from CM1 would occur in the central delta in CZs 3-6, and 8. Most of the permanent loss of habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Permanent habitat loss would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary loss of habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation.

  Habitat loss from CM1 activities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. There are no occurrences of yellow-breasted chat that overlap with the CM1 construction footprint. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*) would minimize the effects of construction on nesting yellow-breasted chats if they were to occur in the area. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Alternative 4 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove approximately 83 acres and temporarily remove 88 acres of yellow-breasted chat habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled yellow-breasted chat habitat in CZ 1, 2, 6, and 11. This total is composed of an estimated 182 acres of primary nesting and migratory habitat, 349 acres of secondary nesting and migratory habitat, and 14 acres of nesting and migratory habitat in the Suisun Marsh and upper Yolo Bypass areas.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 49 acres of modeled yellow-breasted chat habitat in CZ 7. This total is comprised of 28 acres of primary nesting and migratory habitat and 21 acres of secondary nesting and migratory habitat. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support yellow-breasted chat habitat.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat over the term of the BDCP. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the study area.

  Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

  Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected*

Natural Communities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 517 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of valley/foothill riparian habitat should be restored/created and 49 acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have an adverse population-level effect on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 813 acres of modeled habitat (6% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the study area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of yellow-breasted chat habitat and potential direct mortality of this special-status species would represent an adverse effect in the absence of other conservation actions. The restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, the habitat that would be lost consists of small, fragmented riparian stands that would not provide high-value habitat for the species. And because the nesting and migratory habitat that would be lost is small relative to the species' range throughout California and North America, Alternative 4 actions would not be expected to have an adverse population-level effect on the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on yellow-breasted chat under Alternative 4 would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impact of construction would be less than significant under CEQA. Alternative 4 would remove 517 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 49 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 49 acres of valley/foothill riparian habitat should be restored/created and 49 acres should be protected to mitigate the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-breasted chat habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, temporal losses of potential habitat as a result of BDCP actions would be expected to have a less-than-significant population-level impact on the species in the near-term time period.

Considering the conservation actions described above, and AMM1–AMM7 and AMM 22, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-breasted chat. Therefore, Alternative 4 would have a less-than-significant impact on yellow-breasted chat.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 813 acres of modeled habitat (6% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the study area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (see Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge* Operations Plan, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-breasted chat habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-breasted chat.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Because of the current infrequent occurrence and small numbers of yellow-breasted chat in the Plan Area, and because *CM5 Seasonally Inundated Floodplain Restoration* would restore and protect contiguous high-value riparian habitat in CZ 7, any such habitat fragmentation is expected to have no or minimal effect on the species.

NEPA Effects: Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions will be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

***CEQA Conclusion*:** The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of Plan Implementation on Yellow-Breasted Chat

Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP, which would ensure 250 foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, reducing the use of an estimated 59 acres of modeled primary nesting and migratory habitat and 119 acres of secondary nesting and migratory habitat. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect on the species.

Methylmercury Exposure: Yellow-breasted chat modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Chats are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the yellow-breasted chat. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Because of the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-breasted chat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-breasted chat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to the species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than significant.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–88 acres of modeled yellow-breasted chat nesting and migratory habitat. No adverse effects of increased inundation frequency on yellow-breasted chat or its habitat are expected because the chat breeding period is outside the period the weir would be operated. Moreover, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 could result in periodic inundation of up to 148 acres of modeled yellow-breasted chat habitat. Inundation of restored floodplains is not expected to affect yellow-breasted chat or its habitat because the chat breeding period is outside the period the floodplains would likely be inundated. In addition, providing for periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for yellow-breasted chat. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increases in the frequency and duration of Yolo Bypass flooding and CM5 floodplain restoration would be expected to create more natural flood regimes that would support riparian habitat, which would result in a beneficial effect on yellow breasted chat.

CEQA Conclusion: Periodic inundation would have a less-than-significant impact on yellow-breasted chat because inundation would occur outside of the breeding season and would not be expected to adversely modify habitat or result in direct mortality of the species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation would be beneficial for yellow-breasted chat.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled nesting habitat for these species is restricted to valley/foothill riparian forest.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-4-43. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP which would also benefit Cooper's hawk and osprey (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the acres of restoration or protection included in the Plan, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-43. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	25	25	16	16	NA	NA
Total Impacts CM1		**25**	**25**	**16**	**16**		
CM2–CM18	Nesting	312	507	88	121	48-82	230
Total Impacts CM2–CM18		**312**	**507**	**88**	**121**	**48-82**	**230**
TOTAL IMPACTS		**337**	**532**	**104**	**137**	**48-82**	**230**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 669 acres (532 acres of permanent loss, 137 acres of temporary loss) of modeled nesting habitat for Cooper's hawk and osprey (Table 12-4-43). Conservation measures that would result in these losses are Water Facilities and Operation (CM1) (which would involve construction of conveyance facilities and transmission lines and establishment and use of reusable tunnel material areas), Yolo Bypass Fisheries Enhancement (CM2), Tidal Natural Communities Restoration (CM4), and Seasonally Inundated Floodplain Restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 water conveyance facilities would result in the combined permanent and temporary loss of up to 41 acres of modeled Cooper's hawk and osprey habitat (Table 12-4-43). Of the 41 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 25 acres would be a permanent loss and 16 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and work areas. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3 and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from CM1 would occur in the central delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. These losses would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for CM1; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on Cooper's hawk and osprey if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of Cooper's hawk and osprey nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential Cooper's hawk and osprey habitat. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration could permanently remove up to 383 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of Cooper's hawk and osprey nesting habitat (42 acres of permanent loss, 33 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. (

Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 4 would remove 441 acres (337 acres of permanent loss, 104 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 41 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 41 acres of nesting habitat should be restored/created and 41 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in Chapter 3, *Conservation Strategy*, of the BDCP). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 669 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of Cooper's hawk and osprey habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities, the effects of habitat loss on Cooper's hawk and osprey under Alternative 4 would not be adverse. Cooper's hawk and osprey are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would be less-than-significant under CEQA. Alternative 4 would remove 441 acres (337 acres of permanent loss, 104 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 41 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 41 acres of nesting habitat should be restored/created and 41 acres should be protected to mitigate the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios. The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125- acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on Cooper's hawk and osprey nesting habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting Cooper's hawk and osprey to a less-than–significant level. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 669 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on Cooper's hawk and osprey.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of Plan Implementation on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2*

Construction Best Management Practices and Monitoring, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

The potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for Project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cooper's hawk and osprey.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates

(Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Cooper's hawk and osprey.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Cooper's hawk and osprey from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could adversely affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, in addition to AMM1–AMM7, would be available to address this adverse effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on cooper's hawk and osprey. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Cooper's hawk and osprey, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4 would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury through the ingestion of fish or small mammals in restored tidal areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would address the uncertainty of methylmercury levels in restored tidal marsh in the study area and better inform potential impacts on Cooper's hawk and osprey.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48-82 acres of modeled Cooper's hawk and osprey breeding habitat However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 230 acres of breeding habitat for Cooper's hawk and osprey. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would not have an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would have a less-than-significant impact on Cooper's hawk and osprey.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-4-44. Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP that would also benefit golden eagles or ferruginous hawk (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least 8.000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-44. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	1,978	1,978	537	537	NA	NA
Total Impacts CM1		**1,978**	**1,978**	**537**	**537**		
CM2–CM18	Foraging	5,450	26,198	376	893	1,158-3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158-3,650**	**3,823**
TOTAL IMPACTS		**7,428**	**28,176**	**913**	**1,430**	**1,158-3,650**	**3,823**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up 29,606 acres of modeled foraging habitat for golden eagle and ferruginous hawk (28,176 acres of permanent loss and 1,430 of temporary loss, Table 12-4-44). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled golden eagle and ferruginous hawk habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from a reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4-6 and 9 would also remove suitable foraging habitat for the species. Approximately 867 acres of impact would be from the placement of reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would occur from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Some of the grassland habitat lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which is also suitable foraging habitat for the species. There are no occurrences of golden eagle or ferruginous hawk that intersect with the CM1 footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled golden eagle and ferruginous hawk foraging habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled golden eagle and ferruginous hawk foraging habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide foraging habitat for golden eagle and ferruginous hawk and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of golden eagle and ferruginous hawk foraging habitat.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat for these species. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled golden eagle and ferruginous hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.

- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to compensate for the CM1 losses of 2,515 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat* would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of modeled golden eagle and ferruginous hawk foraging habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

***NEPA Effects*:** The loss of golden eagle and ferruginous hawk habitat and potential mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the effects of habitat loss and potential for direct mortality on golden eagle and ferruginous hawk under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to mitigate the CM1 losses of 2,515 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11. (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on golden eagle and ferruginous hawk foraging habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. However, the acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. The implementation of the conservation actions described above, in addition to AMMs2-AMM7, and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat* would reduce the impact of habitat loss in the near-term to less than significant.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of modeled golden eagle and ferruginous hawk foraging habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on golden eagle and ferruginous hawk foraging habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species; however, considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat,* the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on golden eagle and ferruginous hawk.

Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide golden eagle and ferruginous hawk foraging habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any potential for powerline collisions.

NEPA Effects**:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater*

Sandhill Crane, the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

CEQA Conclusion**:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on golden eagle or ferruginous hawk.

Impact BIO-115: Indirect Effects of Plan Implementation on Golden Eagle and Ferruginous Hawk

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects**:** Indirect effects on golden eagle and ferruginous hawk as a result of Plan implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 4 implementation would not have an adverse effect on golden eagle and ferruginous hawk.

CEQA Conclusion**:** Indirect effects on golden eagle and ferruginous hawk as a result of Plan implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 4 implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat (Table 12-4-44).Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-4-44).

Golden eagles and ferruginous hawks would not likely use inundated areas for foraging, and increased frequency and duration of inundation of grassland habitats may affect prey populations that have insufficient time to recover following inundation events. However, periodically inundated habitat would not be expected to have an adverse effect on local or migratory golden eagles or the wintering ferruginous hawk populations in the study area.

NEPA Effects: Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would not be expected to have an adverse effect on the wintering golden eagle or ferruginous hawk populations in the study area.

CEQA Conclusion: Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would be expected to have a less-than-significant impact on the golden eagle and ferruginous hawk populations in the study area.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-4-45. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP which would also benefit cormorants, herons, and egrets (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–

AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, and Mitigation Measures BIO-75 and BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-45. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting (Rookeries)	37	37	24	24	NA	NA
Total Impacts CM1		**37**	**37**	**24**	**24**		
CM2–CM18	Nesting (Rookeries)	387	684	88	123	51–92	266
Total Impacts CM2–CM18		**387**	**684**	**88**	**123**	**51–92**	**266**
TOTAL IMPACTS		**424**	**721**	**112**	**147**	**51–92**	**266**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 868 acres of modeled nesting habitat (721 acres of permanent loss, 147 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-4-45). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 water conveyance facilities would result in the combined permanent and temporary loss of up to 61 acres of modeled nesting habitat for cormorants, herons, and egrets. (Table 12-4-45). Of the 61 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 37 acres would be a permanent loss and 24 acres would be a temporary loss of habitat. Activities that would impact modeled nesting habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities, and temporary work areas. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from CM1 would occur in the central delta in CZs 3- 6, and CZ 8. Habitat loss from CM1 activities would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of nesting cormorants, herons, or egrets that overlap with the construction footprint of CM1; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to minimize impacts on cormorants, herons and egrets if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 177 acres of nesting habitat (89 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential nesting habitat. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 552 acre of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species. There is one CNDDB occurrence of a great blue heron rookery that overlaps with the hypothetical restoration footprint for tidal restoration. The occurrence is on Decker Island and tidal restoration could potentially impact the nest trees from inundation. This effect would need to be addressed within the project specific analysis for tidal restoration projects.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 43 acres and temporarily remove approximately 35 acres of potential cormorants, heron, and egret nesting habitat. These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.
- Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. To avoid adverse effects on these species, existing known nest sites would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address these adverse effects on cormorants, herons, and egrets.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If birds were to nest

in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measures BIO-75 and BIO-117 would be available to address these effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 536 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 61 acres of breeding habitat should be restored/created and 61 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid adverse effects on individuals, existing nests and rookeries would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address adverse effects on nesting cormorants, herons, and egrets.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 868 acres of potential breeding habitat (5% of the potential breeding habitat in the Plan Area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites and for the BDCP to avoid an adverse effect on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

NEPA Effects: The loss of cormorant, heron, and egret habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities, the effects of habitat loss on cormorants, herons and egrets under Alternative 4 would not be adverse. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries* would be available to address adverse effects on nesting cormorants, herons, and egrets.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under NEPA. Alternative 4 would remove 536 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 61 acres of breeding habitat should be restored/created and 61 acres should be protected to mitigate the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and implementation of those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1–AMM7, AMM10, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 868 acres of potential breeding habitat (5% of the potential breeding habitat in the Plan Area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (see Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites and for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts sufficient to compensate for the loss of riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, AMM10, *AMM18 Swainson's Hawk* and Mitigation Measures BIO-75 and BIO-117, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of these species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of Plan Implementation on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that cormorant, heron, and egret tissue concentrations would not measurably increase as a result of CM1 implementation.

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect on cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cormorants, herons or egrets.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. Where restoration design and adaptive management cannot fully address the high potential for methylmercury production while also meeting restoration objectives, alternate restoration areas would be considered on a project-specific basis. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San

Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would represent an adverse effect in the absence of other conservation actions. This impact would be significant. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium which could result in mortality of special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-75 and BIO-117, indirect effects of plan implementation would not result in a substantial adverse effect on cormorants, herons, and egrets through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries), therefore all direct and indirect impacts on rookeries must be avoided.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 51–92 acres of modeled breeding habitat for cormorants, herons and egrets. However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 266 acres of breeding habitat for cormorants, herons and egrets. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would not result in an adverse effect on cormorants, herons and egrets.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would have a less-than-significant impact on cormorants, herons and egrets.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-4-46. Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP which would also benefit short-eared owl and northern harrier (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.2, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species, AMM1–AMM7, *AMM27 Selenium Management* and Mitigation Measure BIO-75, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-46. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting and Foraging	2,231	2,231	724	724	NA	NA
Total Impacts CM1		**2,231**	**2,231**	**724**	**724**		
CM2–CM18	Nesting and Foraging	12,281	46,700	471	1,224	2,926-8,060	5,978
Total Impacts CM2–CM18		**12,281**	**46,700**	**471**	**1,224**	**2,926-8,060**	**5,978**
TOTAL IMPACTS		**14,512**	**48,931**	**1,195**	**1,948**	**2,926-8,060**	**5,978**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 50,879 acres of modeled habitat for short-eared owl and northern harrier (of which 48,931 acres would be a permanent loss and 1,948 acres would be a temporary loss of habitat, Table 12-4-46). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass Fisheries Enhancement (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), grassland restoration (CM8), vernal pool and wetland restoration (CM9), marsh restoration (CM10) and construction of conservation hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,955 acres of modeled short-eared owl and northern harrier habitat (2,231 acres of permanent loss, 724 acres of temporary loss) from CZs 3–6 and CZ 8. Activities that would impact modeled habitat include tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary work areas. The majority of habitat removed would consist of grassland and alfalfa fields. There are no CNDDB or DHCCP surveys records of occurrences of nesting short-eared owl that overlap with the construction footprint of CM1. However, there are two DHCCP occurrences of northern harrier that overlap with the footprint of a shaft associated with the pumps at Clifton Court Forebay and a permanent transmission line north of the forebay. Two DHCCP occurrences also overlap with the temporary impact footprint from geotechnical explorations. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on short-eared owl and northern harrier if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement (CM2) would permanently remove 1,021 acres of modeled short-eared owl and northern harrier habitat in the Yolo Bypass in CZ 2. In addition, 471 acres of habitat would be temporarily removed. The impact would primarily consist of loss of acreages of pastures. The conversion is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 39,017 acres of modeled short-eared owl and northern harrier habitat. The majority of the losses would be managed wetlands and cultivated lands in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. Tidal restoration actions through CM4 would restore an estimated 55,000 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the extent and value of their nesting habitat. Grizzley Island supports the only known resident population of short-eared owls in the Suisun Marsh and Sacramento-San Joaquin River Delta (Roberson 2008). Grizzley Island does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this is an important breeding area for short-eared owl and if restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding short-eared owls could likely be adverse. Future NEPA and CEQA analysis would be conducted for restoration projects under BDCP and if restoration was proposed to occur outside of the hypothetical footprints used for this programmatic analysis, potential impacts on these species would be captured in the project-level analysis (see BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,086 acres of modeled short-eared owl and northern harrier habitat (1,332 permanent, 754 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 623 acres of short-eared owl and northern harrier habitat as part of tidal restoration and 2,479 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,066 acres of cultivated lands to grassland in CZs 1, 2, 4, 5, 7, 8, and 11. The resulting 2,000 acres of grassland would provide habitat for short-eared owl and northern harrier.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to minimize these adverse effects.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of short-eared owl and northern harrier habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 15,707 acres of modeled habitat (14,512 permanent, 1,195 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,955 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 2,955acres of habitat should be restored and 2,955acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses. The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 50,879 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration,* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects: The loss of short-eared owl and northern harrier habitat and potential direct mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss from Alternative 4 would not be adverse. Short-eared owl and northern harrier are not covered species under the BDCP, and preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the adverse effect of direct mortality on short-eared owl and northern harrier.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 15,707 acres of modeled habitat (14,512 permanent, 1,195 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,955 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 2,955 acres of habitat should be restored and 2,955 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses. The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. In order for the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

In the absence of other conservation actions, effects on short-eared owl and northern harrier would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and implementation of those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 50,879 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce the impact to a less-than-significant level.

In the absence of other conservation actions, effects on short-eared owl and northern harrier would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

***NEPA Effects*:** The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4 would not result in an adverse effect on short-eared owl or northern harrier.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4 would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of Plan Implementation on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to short-eared owl and northern harrier could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in the BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on short-eared owl and northern harrier.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration).

Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce short-eared owl and northern harrier use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Tidal habitat restoration is unlikely to have an adverse effect on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for short-eared owl and northern harrier, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on short-eared owl and northern harrier with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. Tidal habitat restoration is unlikely to have a significant impact on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 4 implementation would would result in a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 2,926–8,060 acres of modeled short-eared owl and northern harrier habitat (Table 12-4-46).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 5,978 acres of modeled habitat (Table 12-4-46), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

***NEPA Effects*:** Periodic inundation of floodplains would not result in an adverse effect on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

***CEQA Conclusion*:** Periodic inundation of floodplains would not have a significant impact on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in the *General Terrestrial Biology Effects* section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on mountain plover. Modeled habitat for mountain plover include grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-4-47. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit the mountain plover (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-47. Changes in Mountain Plover Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Wintering	1,978	1,978	537	537	NA	NA
Total Impacts CM1		**1,978**	**1,978**	**537**	**537**		
CM2–CM18	Wintering	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**7,428**	**28,176**	**913**	**1,430**	**1,158–3,650**	**3,823**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 29,606 acres of modeled wintering habitat for mountain plover (28,176 acres of permanent loss and 1,430 of temporary loss, Table 12-4-47). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled mountain plover habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; t construction of the intermediate forebay; and from a reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4-6 and 9 would also remove suitable habitat for the species. Approximately 867 acres of impact would be from the placement of reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would occur from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. There are no CNDDB occurrences of mountain plover that intersect with the CM1 footprint. However, the study area does overlap with the wintering range for the species. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled mountain plover wintering habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled mountain plover habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of mountain plover wintering habitat as part of tidal restoration and 1,489 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide wintering habitat for mountain plover and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of mountain plover habitat.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available mountain plover habitat. Management of grasslands and cultivated lands for mountain plover such as grazing or mowing would make habitat temporarily unavailable for the species but would ultimately make the habitat more suitable for mountain plover. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled mountain plover habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.

- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to compensate for the CM1 losses of 2,515 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on mountain plover wintering in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand mountain plover wintering habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also modeled habitat for wintering mountain plover. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for mountain plover.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for mountain plover. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of modeled mountain plover wintering habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential wintering habitat for mountain plover. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of

these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of mountain plover habitat and potential mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat,* the effects of habitat loss and potential direct mortality on mountain plover under Alternative 4 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled wintering habitat for mountain plover in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to mitigate the CM1 losses of 2,515 acres of mountain plover habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover wintering habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on mountain plover. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential habitat for mountain plover wintering in the study area. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide habitat for mountain plover.

These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on mountain plover would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts and thus there would be minimal lag time between impacts and those measures designed to offset those impacts to natural communities and the species that use them. In addition, implementation of AMM1-AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat* would reduce this potential impact in the near-term to a less-than-significant level.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of mountain plover habitat during the term of the Plan (11% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, effects on mountain plover would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on mountain plover.

Mitigation Measure BIO-125: Compensate for the Near-term Loss of Mountain Plover Wintering Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide habitat for mountain plover such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

NEPA Effects: New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4would not result in an adverse effect on mountain plover.

CEQA Conclusion: New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely because of plover flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of Plan Implementation on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover wintering habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on mountain plover as a result of Plan implementation could have adverse effects on the species through the modification of habitat. With the With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4 implementation would not have an adverse effect mountain plover.

CEQA Conclusion: Indirect effects on mountain plover as a result of Plan implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4 implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled mountain plover wintering habitat (Table 12-4-47). Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled mountain plover habitat (Table 12-4-47).

NEPA Effects: Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would have a less-than-significant impact on mountain plover because birds would be expected to move to adjacent foraging habitat.

Black Tern

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to freshwater wetland and rice in CZ 2.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled habitat for black tern as indicated in Table 12-4-48. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit the black tern (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect 700 acres of cultivated lands, with at least 500 acres consisting of rice land, to expand upon and buffer newly restored/created nontidal perennial habitat in CZ 2, (Objective GGS2.3, associated with CM3).
- Protect up to 1,700 acres of rice land or equivalent habitat (e.g. perennial wetland) in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake. Any remaining acreage (from a total 2,740 acre commitment) will consist of rice land or equivalent-value habitat outside the Yolo Bypass in CZs 1, 2, 4, or 5 (Objective GGS3.1, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

As explained below, with the restoration and protection of these amounts of habitat, in addition to management activities that would enhance this habitat for the species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on black tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-48. Changes in Black Tern Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	Nesting	306	490	1	1	791–1,582	0
Total Impacts CM2–CM18		**306**	**490**	**1**	**1**	**791–1,582**	**0**
TOTAL IMPACTS		**306**	**490**	**1**	**1**	**791-1,582**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

Alternative 4 conservation measures would result in the permanent loss of up to 491 acres of modeled nesting habitat for black tern, consisting of freshwater wetlands and rice in CZ 2 (Table 12-4-48). Conservation measures that would result in these losses are Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), grassland restoration (CM8) and nontidal marsh restoration (CM10). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 31 acres of modeled black tern habitat in the Yolo Bypass in CZ 2. In addition, 1 acre of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 199 acres of modeled black tern habitat in CZ 2.
- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 52 acres of rice lands to grassland in CZ 2 by the late-long time period. An estimated 30 acres of impact would occur in the first 10 years.
- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10* would result in the permanent removal of 208 acres of black tern nesting habitat in in CZ 2. An estimated 46 acres would be removed in the first 10 years.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could disturb nesting black terns if they were to nest in the vicinity of a worksite. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of black tern would be minimized with the implementation of and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds.
- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect black tern nesting adjacent to maintenance areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged black tern individuals if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If black tern were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of Mitigation Measure BIO-75.
- Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. This potential impact is further described under Impact BIO-129c below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements,*

CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to compensate for the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to avoid an adverse effect on black tern from habitat loss, protection and restoration of 307 acres of rice and/or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would be available to address this adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3 *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of black tern nesting habitat and potential mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection associated with CM3, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss under Alternative 4 would not be adverse. Black tern is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to mitigate the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3 *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to

1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored and protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to compensate for black tern habitat loss, the protection and restoration of 307 acres of rice or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would reduce this potential impact to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Black tern is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction would be required to ensure that nests are detected and avoided. In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1-AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, which would require 1:1 protection of habitat in CZ 2 in the near-term time frame, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3 *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments

through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting terns during preconstruction surveys and ensure that active nests are avoided which would reduce the potential impact on nesting black tern to a less-than-significant level. In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 4's habitat protection provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on black tern.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat

Because there is no near-term acreage commitment associated with the protection of rice and the restoration of freshwater wetlands in CZ 2, BDCP proponents must protect and restore rice and/or freshwater wetlands at a 1:1 ratio for each acre of habitat impacted in CZ 2.

Impact BIO-129b: Indirect Effects of Plan Implementation on Black Tern

If black terns were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting black terns. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants that could affect black terns in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including black tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on black tern.

Because of the uncertainty that exists at this programmatic level of review, there could be an effect on black tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat. AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals.

Tidal habitat restoration could result in increased exposure of black tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce these impacts to a less-than–significant level.

Tidal habitat restoration could result in increased exposure of black tern to selenium, which could result in the mortality of a special-status species. This impact would be significant. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With AMM27 in place, potential effects of increased exposure of black tern to selenium would be reduced to a less-than-significant impact.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass would inundate 791–1,582 acres of suitable black tern nesting habitat (land currently managed as rice in CZ 2). Inundation would occur during the nonbreeding season but could reduce the availability of nesting habitat during years that flooding extends into the nesting season (past March). Extended inundation of the Yolo Bypass would not be expected to affect black tern nesting habitat. However, if periodic inundation took land out of rice production, this could have an adverse effect on black tern nesting habitat. Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. The BDCP has committed to protect, restore and/or create up to 1,700 acres of rice in the Yolo Bypass (Objective GGS3.1). These acres of rice would be protected in areas that are less susceptible to inundation, which would benefit the black tern during years in which the magnitude and duration of inundation were increased.

NEPA Effects: Flooding of the Yolo Bypass is not expected to adversely affect nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential effect would not be adverse with the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1 in the BDCP.

CEQA Conclusion: Flooding of the Yolo Bypass is not expected to have a significant impact on nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential impact would be reduced to less than significant by the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1 in the BDCP.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of breeding habitat in the Plan Area, which includes grassland vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture. Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-4-49. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit the California horned lark and the grasshopper sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the at least 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-49. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	1,978	1,978	537	537	NA	NA
Total Impacts CM1		**1,978**	**1,978**	**537**	**537**	**NA**	**NA**
CM2–CM18	Breeding	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**7,428**	**28,176**	**913**	**1,430**	**1,158–3,650**	**3,823**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 29,606 acres of modeled nesting habitat for California horned lark and grasshopper sparrow (of which 28,176 acres would be a permanent loss and 1,430 acres would be a temporary loss of habitat, Table 12-4-49). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled California horned lark and grasshopper sparrow habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from a reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4-6 and 9 would also remove suitable foraging habitat for the species. Approximately 867 acres of impact would be from the placement of reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would occur from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 2 and 3 (6 occurrences), in the Stone Lakes NWR. However, the CM1 footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting California horned larks or grasshopper sparrows. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled California horned lark and grasshopper sparrow habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled California horned lark and grasshopper sparrow nesting habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of California horned lark and grasshopper sparrow nesting habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide nesting habitat for California horned lark and grasshopper sparrow and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of California horned lark and grasshopper sparrow nesting habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.
- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled California horned lark and grasshopper sparrow habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to compensate for the CM1 losses of 2,515 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat* would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) and would provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of California horned lark and grasshopper sparrow habitat and potential mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the effects of habitat loss on California horned lark and grasshopper sparrow under Alternative 4 would not be adverse. California horned lark and grasshopper sparrow are not covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 5,030 acres should be protected to mitigate the CM1 losses of 2,515 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on California horned lark and grasshopper sparrow habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. This impact would be significant. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. With the acres of habitat protection and restoration described above, in addition to AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat,* Alternative 4 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 4 would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid impacts on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

In the absence of other conservation actions, the effects on California horned lark and grasshopper sparrow habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. This impact would be significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and*

Grasshopper Sparrow Habitat, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide California horned lark and grasshopper sparrow habitat such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1 protection. Additional grassland protection, enhancement, and management may be substituted for the protection of cultivated lands.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. *AMM20 Greater Sandhill Crane* would minimize the risk of bird strikes by installing flight diverters on new and selected existing powerlines.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane*, the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane*, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of Plan Implementation on California Horned Lark and Grasshopper Sparrow

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations.

Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to California horned lark and grasshopper sparrow nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4 implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. California horned lark and grasshopper sparrow are not covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

CEQA Conclusion: Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4 implementation could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on California Horned Lark and Grasshopper Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158-3,650 acres of modeled California horned lark and grasshopper sparrow habitat (Table 12-4-49).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-4-49).

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects: Periodic inundation of floodplains would not have adverse effects on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season and inundation.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis includes tidal freshwater, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZ 2, 4, and 11. Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-4-50. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit least bittern and white-faced ibis (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-50. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] Yolo	Periodic[d] Floodplain
CM1	Nesting	1	1	3	3	NA	NA
Total Impacts CM1		**1**	**1**	**3**	**3**	**NA**	**NA**
CM2–CM18	Nesting	5,134	13,063	45	45	961–2,672	NA
Total Impacts CM2–CM18		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**
TOTAL IMPACTS		**5,135**	**13,064**	**48**	**48**	**961–2,672**	**NA**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. Yolo periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 13,112 acres of modeled habitat for least bittern and white-faced ibis (13,064 acres of permanent loss and 48 of temporary loss, Table 12-4-50). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 4 acres of modeled least bittern and white-faced ibis habitat (1 acre of permanent loss, 3 acres of temporary loss) from CZ 4. Permanent impacts on habitat would occur from a reusable tunnel material storage site north of Twin Cities Road and east of the Intermediate Forebay. Temporary impacts would occur from the construction of two temporary transmission lines one extending east along Lambert Road from the Lambert Road Vent Shaft, and one extending south from the Lambert Road Vent Shaft to the Intermediate Forebay. The construction footprint for CM1 does not overlap with any occurrences of least bittern or white-faced ibis. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on least bittern and white-faced ibis if they were to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 55 acres of modeled least bittern and white-faced ibis habitat in the Yolo Bypass in CZ 2. In addition, 45 acres of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 13,008 acres of modeled least bittern and white-faced ibis habitat in CZ 2, 4, and 11 by the late long-term time period.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce effects.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Construction-related activities could also flush least bittern adults from nests and lead to collision with man-made objects (Sterling 2008). Mitigation Measure BIO-75 would require preconstruction surveys in and adjacent to work areas and, if nests were present, no disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 5,183 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,135 acres of permanent loss, and 48 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 4 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 4 acres of habitat should be restored and 4 acres of habitat should be protected to compensate for the CM1 losses of 5 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland and protecting and enhancing 4,800 acres of managed wetland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 13,112 acres (13,064 acres of permanent loss, 48 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

***NEPA Effects*:** The loss of least bittern and white-faced ibis habitat and potential mortality of these special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with the habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss under Alternative 4 on least bittern and white-faced ibis would not be adverse. Least bittern and white-faced ibis are not covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Alternative 4 would remove 5,183 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,135 acres of permanent loss, and 48 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 4 acres), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 4 acres of habitat should be restored and 4 acres of habitat should be protected to mitigate the CM1 losses of 4 acres of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal freshwater emergent wetland and 4,800 acres of managed wetland in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on least bittern and white-faced ibis habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. This impact would be significant. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. With the acres of habitat protection and restoration described above, in addition to AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, Alternative 4 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 4 would have a less-than-significant impact on least bittern and white-faced ibis.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 13,112 acres (13,064 acres of permanent loss, 48 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting least bittern and white-faced ibis and to a less-than-significant level.

In the absence of other conservation actions, the effects on least bittern and white-faced ibis habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. This impact would be significant. Least bittern and white-faced ibis are not covered species under the BDCP. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters which would reduce bird strike risk of least bittern and white-faced ibis.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of Plan Implementation on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could adversely affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation*

Strategy, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. Where restoration design and adaptive management cannot fully address the high potential for methylmercury production while also meeting restoration objectives, alternate restoration areas would be considered on a project-specific basis. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of other conservation actions. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in the BDCP, Appendix 5.D, *Contaminants*). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of plan implementation would represent a substantial adverse effect in the absence of other conservation actions. This impact would be significant. The incorporation of AMM1–AMM7 into the

BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of plan implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other conservation measures. This would be a significant impact. With AMM1-AMM7, *AMM27 Selenium Management*, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 4 plan implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 961-2,672 acres of modeled least bittern and white-faced ibis habitat (Table 12-4-50). However, no adverse effects of increased inundation frequency on nesting habitat would be expected because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types. Inundation would occur in the nonbreeding season and wetlands supporting habitat would not be expected to be affected by flood flows.

NEPA Effects: Periodic inundation of Yolo Bypass would not be expected to have adverse effects on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

CEQA Conclusion: Periodic inundation of Yolo Bypass would not be expected to have a significant impact on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

Loggerhead Shrike

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-4-51. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit loggerhead shrike (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-51. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	High-value	1,978	1,978	537	537	NA	NA
	Low-value	1,269	1,269	441	441	NA	NA
Total Impacts CM1		**3,247**	**3,247**	**978**	**978**	**NA**	**NA**
CM2–CM18	High-value	5,450	26,198	376	893	777–2,423	3,823
	Low-value	1,801	17,575	97	624	672–1,996	4,315
Total Impacts CM2–CM18		**7,251**	**43,773**	**474**	**1,517**	**1,830–5,646**	**8,138**
Total High-value		**7,428**	**28,176**	**913**	**1,430**		
Total Low-value		**3,070**	**18,844**	**538**	**1,065**		
TOTAL IMPACTS		**10,498**	**47,020**	**1,451**	**2,495**	**1,830–5,646**	**8,138**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. Yolo periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 49,515 acres of modeled habitat for loggerhead shrike (of which 29,606 acres is of high-value and 19,909 acres is of low value, Table 12-4-51). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), natural communities enhancement and management (CM11) and construction of conservation hatcheries (CM18). The majority of habitat loss (33,244 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of high-value loggerhead shrike habitat (1,978 acres of permanent loss, 537 acres of temporary loss). In addition, 1,710 acres of low-value habitat would be removed (1,269 acres of permanent loss, 441 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from a reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4-6 and 9 would also remove suitable foraging habitat for the species. Approximately 796 acres of impact would be from the placement of reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would occur from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*.

  Loggerhead shrikes nest in high abundance in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Impacts from CM1 that overlap with recorded loggerhead shrike nest occurrences (from CNDDB and DHCCP surveys) include the construction of the new forebay (5 occurrences), the Reusable Tunnel Material storage area north-west of the existing forebay (2 occurrences), permanent transmission line south of Clifton Court Road and west of the existing Clifton Court Forebay (1 occurrence), a permanent transmission line that extends along the northern extent of the Reusable Tunnel Material storage areas west of the existing forebay (1 occurrence). Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting loggerhead shrikes. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of high-value loggerhead shrike habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 182 acres of low-value habitat would be removed (85 acres of permanent loss, 97 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of high-value loggerhead shrike habitat and 12,364 acres of low-value habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of high-value loggerhead shrike habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 370 acres of high-value loggerhead shrike habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration. In addition, 503 acres of low-value habitat would be removed as a part of tidal restoration and 1,971 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide habitat for loggerhead shrike and would result in the conversion of 1,849 acres of cultivated lands to high-value grassland.

- *CM10 Nontidal Marsh Restoration*: Implementation of CM10 would result in the permanent removal of 705 acres of high-value loggerhead shrike habitat and 735 acres of low-value loggerhead shrike habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Fences (e.g. barbed wire) installed as part of CM11 in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (Chapter 4, *Covered Activities and Associated Federal Actions*, of the BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If the species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value loggerhead shrike habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. Hatchery construction is expected to occur within the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 3,608 acres of low-value habitat would be removed or converted in the near-term (CM1, 1,710 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 5,030 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of

alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat* would be available to address the adverse effect of near-term high-value habitat loss. With the management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential effect from the loss of low-value loggerhead shrike foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of high-value loggerhead shrike habitat during the term of the Plan. In addition, 19,909 acres of low-value loggerhead shrike habitat would be impacted. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7 Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3 *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

***NEPA Effects*:** The loss of logghterhead shrike habitat and potential mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities, and AMM18 Swainson's Hawk,* and with implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat,* which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss on loggerhead shrike under Alternative 4 would not be adverse. Loggerhead shrike is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 8,341 acres (7,428 permanent, 913 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 2,515 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 3,606 acres of low-value habitat would be removed or converted in the near-term (CM1, 1,710 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using these typical ratios would indicate that 5,030 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (see Table 3-4 in Chapter 3 *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1. With the acres of habitat protection and restoration described above, in addition to Mitigation Measure BIO-138, *Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat*, Alternative 4 would not result in a substantial adverse effect through loss of high-value habitat. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential substantial impact from the loss of low-value loggerhead shrike foraging habitat. In addition, AMM1-AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid potentially significant impacts on nesting individuals. With these measures in place, Alternative 4 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 4 would have a less-than-significant impact on loggerhead shrike.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 29,606 acres of high-value loggerhead shrike habitat during the term of the Plan. In addition, 19,909 acres of low-value loggerhead shrike habitat would be impacted. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3 *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective

CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on loggerhead shrike.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat

Because the BDCP does not include acreage commitments for the protection of crop types in the near-term time period, DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa as high-value loggerhead shrike habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on loggerhead shrike.

CEQA Conclusion: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 4 would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of Plan Implementation on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on loggerhead shrike as a result of Alternative 4 implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The loggerhead shrike is not a covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 4 implementation could have a significant impact on these species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,830–5,646 acres of modeled loggerhead shrike habitat (consisting of approximately 777–2,423 acres of high-value habitat; Table 12-4-51). Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 8,138 acres of modeled habitat (Table 12-4-51), consisting of 3,823 acres of high-value and 4,315 acres of low-value habitat.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would result in a less-than-significant impact on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

Song Sparrow "Modesto" Population

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on Modesto song sparrow. The Modesto song sparrow is common and ubiquitous throughout the Plan area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-4-52. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit Modesto song sparrow (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZ 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10)
- Create 500 acres of managed wetlands in CZ 3, 4, 5, or 6 (Objectives GSHC1.3 and GSHC1.4, associated with CM10).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-52. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	40	40	24	24	NA	NA
Total Impacts CM1		**40**	**40**	**24**	**24**	**NA**	**NA**
CM2–CM18	Nesting	2,444	3,253	133	169	81-158	284
Total Impacts CM2–CM18		**2,444**	**3,253**	**133**	**169**	81-158	284
TOTAL IMPACTS		**2,484**	**3,293**	**157**	**193**	**81-158**	**284**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 3,486 acres of modeled habitat for Modesto song sparrow (3,293 acres of permanent loss and 232 acres of temporary loss, Table 12-4-52). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require a period of time for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 64 acres of modeled Modesto song sparrow habitat (40 acres of permanent loss, 24 acres of temporary loss) from CZs 3-6 and CZ 8. The CM1 construction footprint overlaps with 77 Modesto song sparrow occurrences and the species is ubiquitous throughout the Delta. The Reusable Tunnel Material storage areas throughout the central Delta overlaps with 24 occurrences, shaft locations along the tunnel alignment overlap with 9 occurrences, the permanent transmission line overlaps with 6 occurrences, and 1 occurrence overlaps with the construction of the new forebay in CZ 8. In addition, temporary impacts overlap with species occurrences including the construction of a transmission line (1 occurrence) and geotechnical exploration zones along the tunnel alignment (17 occurrences). Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Construction of the water conveyance facilities and the resultant impacts would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 143 acres of modeled Modesto song sparrow habitat in the Yolo Bypass in CZ 2. In addition, 133 acres of habitat would be temporarily removed. These losses would occur in the near-term timeframe and primarily consist of valley/foothill riparian natural community and managed wetland. The loss is expected to occur during the first 10 years of Alternative 4 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated loss of 3,066 acres of modeled Modesto song sparrow habitat by the late long-term timeframe.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 80 acres of modeled Modesto song sparrow habitat (44 permanent, 36 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7. The BDCP is expected to restore approximately 5,000 acres of valley/foothill riparian natural community. These lands would be managed as a mosaic of seral stages, age classes, and plant heights, some of which would provide suitable nesting habitat for Modesto song sparrow.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP.

  Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If the species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 2,641 acres of modeled habitat (2,484 permanent, 157 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 64 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 64 acres of suitable habitat should be restored/created and 64 acres should be protected to compensate for the CM1 losses of 64 acres of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs 2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areasBDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 3,486 acres (3,293 acres of permanent loss, 193 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs 2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects: The loss of Modesto song sparrow habitat and potential mortality of this special-status species under Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss on Modesto song sparrow under Alternative 4 would not be adverse. The Modesto song sparrow is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 2,641 acres of modeled habitat (2,484 permanent, 157 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 64 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 64 acres of suitable habitat should be restored/created and 64 acres should be protected to mitigate the CM1 losses of 64 acres of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding a significant impact of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs 2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on Modesto song sparrow habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures. With the acres of habitat protection and restoration described above, in addition to AMM1-AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* Alternative 4 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 4 would have a less-than-significant impact on Modesto song sparrow.

Late Long-Term Timeframe

Alternative 4 as a whole would result in the permanent loss of and temporary effects on 3,486 acres (3,293 acres of permanent loss, 193 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for

Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs 2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on Modesto song sparrow habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

***NEPA Effects*:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

***CEQA Conclusion*:** The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow population.

Impact BIO-144: Indirect Effects of Plan Implementation on Modesto Song Sparrow

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions,* of the Final EIR/EIS), although there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 including *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury*

Management (as revised in Appendix 11F, *Substantive BDCP Revisions*) contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on Modesto song sparrow.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Modesto song sparrow.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Modesto song sparrow from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 4 water conveyance facilities could adversely affect individuals in the absence of other conservation actions. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would minimize this adverse effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Modesto song sparrow, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 4 water conveyance facilities could have a significant impact on the species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would address the potential impacts of methylmercury levels in restored tidal marsh in the study area.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. With implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 81–158 acres of modeled Modesto song sparrow habitat. However, inundation would occur during the nonbreeding season. Reduced foraging habitat availability would be expected during the fledgling period of the nesting season due to periodic inundation.

Based on hypothetical floodplain restoration, construction of setback levees from seasonally inundated floodplain restoration (CM5) could result in periodic inundation of up to approximately 284 acres of Modesto song sparrow modeled habitat (Table 12-4-52).

The periodic inundation of the Yolo Bypass (CM2) and of seasonal floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat, but may reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).

***NEPA Effects*:** Periodic effects of inundation would not result in an adverse effect on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

***CEQA Conclusion*:** Periodic effects of inundation would have a less-than-significant impact on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

Bank Swallow

This section describes the effects of Alternative 4, including construction and implementation of other conservation components, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70-90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Construction and restoration associated with Alternative 4 conservation measures would not result in the direct loss of modeled habitat for bank swallow. However, indirect effects of noise and visual disturbance from CM2 Yolo Bypass Fisheries Enhancements and *CM4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat.

As explained below, impacts on bank swallow under Alternative 4 would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-4-53. Changes in Bank Swallow Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	Yolo	Floodplain
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Nesting	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities from *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in CZ 2 and CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

NEPA Effects: Construction activities associated with habitat restoration could adversely affect bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in adverse effects on bank swallows if active colonies were present within 500 feet of work areas.

Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this effect.

***CEQA Conclusion*:** Construction activities associated with habitat restoration could result in a significant impact on bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, BDCP proponents will not construct conservation components during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWR will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the March when the swallows have nested and layed eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses that resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento River (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Chapter 5, Section 5.3.1, *Methods for Analysis*, for a description of the model).

On the Sacramento River at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 4 could increase between April and August in below normal, dry, and critical years based on modeling assumptions and output (Table 1 in Section 11C.4.1.1 and Table 3 in Section 11C.4.1.2 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) which could lead to inundation of active colonies. However, model outputs indicate that flows under Existing Conditions and the predicted flows in the late long-term without the project (NAA) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (Table 15 in Section 11C.4.1.8 and Table 17 in Section 11C.4.1.9 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). In addition, at the Verona flow gauge on the Sacramento River in average water years (Table 7 in Section 11C.4.1.4 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) flows are predicted to be greater than 14,000 cfs during the breeding season (April through August,) which could lead to bank collapse. However, flows of this height are recorded under Existing Conditions at this flow gague and are also predicted for the late long-term without the project (NAA).

NEPA Effects: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4 would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

CEQA Conclusion: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4 would not differ substantially from those under Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitoring[2] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would result inloss of active nest sites or degradation of available nesting habitat, and the extent to which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on yellow-headed blackbird. The habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. These natural communities support aquatic insects which are important prey items for yellow-headed blackbird young (Beedy 2008). Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-4-54. Full implementation of Alternative 4 would include the following biological objectives over the term of the BDCP which would also benefit yellow-headed blackbird (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).

[2] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objective ASWNC1.1, Objective VPNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat (Table 12-4-54) in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objective GNC2.4, associated with CM11)

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-54. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 4

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	19	19	39	39	NA	NA
	Foraging	2,652	2,652	656	656	NA	NA
Total Impacts CM1		**2,671**	**2,671**	**695**	**695**	**NA**	**NA**
CM2–CM18	Nesting	5,814	13,902	45	46	961–2,678	18
	Foraging	5,612	26,673	376	905	368–1,476	2,701
Total Impacts CM2–CM18		**11,426**	**40,575**	**421**	**951**	**1,495–4,394**	**2,719**
Total Nesting		**5,833**	**13,921**	**84**	**85**	961–2,678	18
Total Foraging		**8,264**	**29,325**	**1,032**	**1,561**	368–1,476	2,701
TOTAL IMPACTS		**14,097**	**43,246**	**1,116**	**1,646**	**1,495–4,394**	**2,719**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 44,892 acres of modeled habitat (14,006 acres of nesting habitat and 30,886 acres of foraging habitat) for yellow-headed blackbird (Table 12-4-54). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 water conveyance facilities would result in the combined permanent and temporary loss of up to 58 acres of yellow-headed blackbird nesting habitat (19 acres of permanent loss and 39 acres of temporary loss). In addition, 3,308 acres of foraging habitat would be removed (2,652 acres of permanent loss, 656 acres of temporary loss). Activities that would impact suitable yellow-headed blackbird habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. The largest losses of foraging habitat would occur from loss of corn. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for CM1. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow-headed blackbirds. Impacts from CM1 would occur in the central delta in CZs 3–6, and CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Impacts from CM1 would occur within the first 10-14 years of Plan implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 100 acres of nesting habitat (55 acres of permanent loss, 45 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,144 acres of foraging habitat would be removed (879 acres of permanent loss, 265 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 4 implementation.
- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation from CM4 would permanently remove or convert an estimated 13,847 acres of nesting habitat, which would consist primarily of managed wetland. In addition, 20,029 acres of foraging habitat would be lost or converted as a result of tidal restoration, over half of which would be from the loss or conversion of alfalfa. However, the resulting 65,000 acres of tidal natural communities would also provide habitat for the species, 24,000 acres of which would be tidal freshwater natural communities providing breeding habitat for yellow-headed blackbird.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 2 acres of yellow-headed blackbird nesting habitat (1 acres of permanent loss, 1 acres of temporary loss) and 1,641 acres of foraging habitat (1,051 acres of permanent loss, 590 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 4 implementation along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 509 acres of yellow-headed blackbird foraging habitat as part of tidal restoration and 2,033 acres as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 926 acres of yellow-headed blackbird agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value. CM8 would result in the restoration of 2,000 acres of grassland foraging habitat in the study area.
- *CM10 Nontidal Marsh Restoration:* Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 988 acres of cultivated lands foraging habitat to nontidal marsh in CZ 2 and CZ 4. Yellow-headed blackbird nesting habitat may develop along the margins of restored nontidal marsh and restoration would also provide foraging habitat for the species.
- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in CM11 that are

designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. CM11 would also include the construction of recreational-related facilities, including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-yellow-headed blackbird foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 4 would remove 5,917 acres (5,833 acres of permanent loss, 84 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally*

Inundated Floodplain Restoration—5,859 acres). In addition, 9,296 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 3,308 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 58 acres of nesting habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of 58 acres of yellow-headed blackbird nesting habitat. In addition, 3,308 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection of nesting habitat; 1:1 protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 14,006 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 30,886 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (Table 3.3-6 in BDCP Chapter 3, *Conservation Strategy*). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***NEPA Effects*:** The loss of yellow-headed blackbird habitat and potential direct mortality of this special-status species associated with Alternative 4 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM8, CM10, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place during all project activities, the effects of habitat loss would not be adverse under Alternative 4. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 4 would remove 5,917 acres (5,833 acres of permanent loss, 84 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 58 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 9,296 acres of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 3,308 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 58 acres of nesting habitat should be restored/created and 58 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 3,308 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 for protection of nesting habitat; 1:1 protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures. With the acres of habitat protection and restoration described above, in addition to AMM1-AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, Alternative 4 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of the species. Therefore, Alternative 4 would have a less-than-significant impact on yellow-headed blackbird.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 14,006 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 30,886 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (see Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickelweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (see Table 3.3-6 in Chapter 3, *Conservation Strategy*, of the BDCP). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 4's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts necessary to compensate for habitat lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-headed blackbird. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would reduce the potential for yellow-headed blackbird collision with transmission lines. Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4 would not result in an adverse effect on yellow-headed blackbird.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 4 would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of Plan Implementation on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on*

Sandhill Crane, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions*), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in the BDCP, Appendix 5.D, *Contaminants*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. Where restoration design and adaptive management cannot fully address the high potential for methylmercury production while also meeting restoration objectives, alternate restoration areas would be considered on a project-specific basis. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-headed blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-headed blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: In the absence of other conservation actions, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4 would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Indirect effects of plan implementation would represent an adverse effect on yellow-headed blackbird in the absence of other conservation measures. This would be a significant impact. With AMM1–AMM7, AMM27, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of plan implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 961–2,678 acres of nesting habitat and 368–2,678 acres of foraging habitat (Table 12-4-54). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 18 acres of nesting habitat and 2,701 acres of nonbreeding habitat (Table 12-4-54) resulting in the temporary loss of these habitats. Foraging yellow-headed blackbirds would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and although foraging habitat may be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and although foraging habitat would be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-4-55. Full implementation of Alternative 4 would also include biological objectives over the term of the BDCP to benefit the riparian brush rabbit (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian brush rabbit involves protecting, restoring or creating, and maintaining habitat and corridors near the largest remaining fragments of habitat and extant populations; providing high-water refugia from flooding; and managing feral predators (dogs and cats) in areas occupied by the species. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5, CM7, and CM11).
- Of the 750 acres of protected valley/foothill riparian natural community protected under Objective VFRNC1.2, protect at least 200 acres of suitable riparian brush rabbit habitat (defined in CM7 Riparian Natural Community Restoration) that is occupied by the species or contiguous with occupied habitat (Objective RBR1.1, associated with 3).
- Of the 1,000 acres of early- to midsuccessional riparian habitat maintained under VFRNC2.2, maintain at least 800 acres within the range of the riparian brush rabbit (CZ 7), in areas that are adjacent to or that facilitate connectivity with occupied or potentially occupied habitat (Objective RBR1.2, associated with CM3, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain at least 300 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Objective 1.3, associated with CM3, CM7, and CM11).

- Create and maintain high-water refugia in the 300 acres of restored riparian brush rabbit habitat and the 200 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Objective RBR1.4, associated with CM7 and CM11).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Objective RBR1.5, associated with CM11).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres of grasslands restored under Objective GNC1.2, protect or restore grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6m associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-55. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	14	14	3	3	NA	NA
	Grassland	164	164	68	68	NA	NA
Total Impacts CM1		**178**	**178**	**71**	**71**	**NA**	**NA**
CM2–CM18	Riparian	0	62	0	35	0	264
	Grassland	0	44	0	20	0	423
Total Impacts CM2–CM18		**0**	**106**	**0**	**55**	**0**	**687**
TOTAL IMPACTS		**178**	**284**	**71**	**126**	**0**	**687**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 4 conservation measures would result in the permanent and temporary loss of up to 114 acres of riparian habitat and 296 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-4-55Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 4 water conveyance facilities would result in the permanent removal of approximately 14 acres of riparian habitat and 164 acres of associated grassland habitat and in the temporary removal of 3 acres of riparian habitat and 68 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-4-55). The riparian habitat that would be removed is of low value for the riparian brush rabbit as it consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 19 acres of riparian habitat and 18 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. The riparian habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by agricultural lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. The habitat that would be removed is not adjacent to any existing conserved lands, and is several miles north and northeast of the northernmost riparian brush rabbit record located northeast of Paradise Cut (Williams et al. 2002). Although the final footprint for tidal natural communities restoration would differ from the hypothetical footprint, compliance monitoring would be implemented to ensure that acreage limits are not exceeded and the measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian brush rabbit.
- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 43 acres of riparian habitat and 26 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late longterm. Levee construction would also result in the temporary removal of 35 acre riparian habitat and 20 acres of grassland habitat for the riparian brush rabbit. Although the effects are considered temporary, five years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected. The value of this habitat for riparian brush rabbit is high: although it consists of small patches and narrow bands of riparian vegetation, these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange.

  Although the final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis, restoration of the river floodplain in CZ 7 would be targeted in the general area of the riparian brush rabbit population. Implementation of adaptive management described in AMM25 would ensure that riparian brush rabbit habitat permanently removed as a result of floodplain restoration does not exceed the maximum allowable habitat loss for this species.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

  Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37 Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.

- Operations and maintenance: Ongoing maintenance of BDCP facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.

- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbit because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian brush rabbit because tidal natural communities restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian brush rabbits: however, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction (AMM25).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 4 would result in permanent and temporary effects combined on 17 acres of riparian habitat and 232 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the near-term loss of riparian brush rabbit habitat would be in an area unlikely to be occupied by the species in CZ 8. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 17 acres of riparian habitat should be restored, 17 acres of riparian habitat should protected, and 464 acres of grassland should be protected for riparian brush rabbit to mitigate near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (see Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RBR1.1–RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 17 acres of riparian habitat restored, 17 acres protected, and 464 acres of grassland protected.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, and *AMM37 Recreation*. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 4 would result in permanent and temporary effects combined on 114 acres of modeled riparian habitat and 296 acres of modeled grassland habitat for riparian brush rabbit, representing 4% and 10% of the riparian and grassland modeled habitat in CZ 6, CZ 7, and CZ 8. Habitat lost in CZ 6 and CZ 8 is fragmented, isolated, and unlikely to support the species. Habitat would also be lost in areas in CZ 7 that provide high-value habitat for the species.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the Plan would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain will be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains will transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas will provide refuge for the riparian brush rabbit during most years. The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

NEPA Effects: In the near-term, the loss of riparian brush rabbit habitat and potential mortality under Alternative 4 would not be an adverse effect because there is little likelihood of riparian brush rabbits being present and because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of riparian brush rabbit riparian and grassland habitat associated with Alternative 4, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM25, and AMM37, the effects of Alternative 4 as a whole on riparian brush rabbit would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be significant under CEQA.

Alternative 4 would result in permanent and temporary effects combined on 17 acres of riparian habitat and 232 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the near-term loss of riparian brush rabbit habitat would be in an area unlikely to be occupied by the species in CZ 8. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3, *Conservation Strategy*, of the BDCP would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 17 acres of riparian habitat should be restored, 17 acres of riparian habitat should protected, and 464 acres of grassland should be protected for riparian brush rabbit to mitigate CM1 losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (see Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RBR1.1-RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 17 acres of riparian habitat restored, 17 acres protected, and 464 acres of grassland protected.

The plan also contains commitments to implement AMM1–AMM7, AMM10, AMM25, and AMM37. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 4 would result in permanent and temporary effects combined on 114 acres of modeled riparian habitat and 296 acres of modeled grassland habitat for riparian brush rabbit, representing 4% and 10% of the riparian and grassland modeled habitat.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the Plan would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

Only a small proportion of the habitat losses would be considered occupied and of high-value. Alternative 4 conservation measures provide for large acreages of riparian brush rabbit riparian and grassland habitat to be protected and restored, and the BDCP includes AMM1–AMM7, AMM10, AMM25, and AMM37, which are directed at minimizing or avoiding potential effects during construction and operation of the conservation measures. Overall, the BDCP would provide a substantial net benefit to the riparian brush rabbit through the increase in available habitat and habitat in protected status.

Considering the habitat restoration and protection associated with CM3,-CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the temporary and permanent losses of riparian and grassland habitat and potential direct mortality of riparian brush rabbit as a result of implementing Alternative 4 would not represent a significant impact through habitat modifications and would not substantially reduce the number or restrict the range of the species. The loss of habitat and potential mortality of riparian brush rabbits would be a less-than-significant impact under CEQA.

Impact BIO-153: Indirect Effects of Plan Implementation on Riparian Brush Rabbit

Noise, lighting, and visual disturbance adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat in the study area. These construction activities would include water conveyance (including transmission line) construction in CZ 8, tidal natural communities restoration construction, and construction of setback levees. Water conveyance construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. Tidal natural communities restoration construction would also potentially affect adjacent riparian habitat and associated grassland habitat for this species: however, adverse effects on the species are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian brush rabbit. The activity most likely to result in noise, lighting, and visual disturbance to riparian brush rabbit is the construction of setback levees for floodplain restoration, which would take place in CZ 7, where the species is known to occur. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 4 would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 4 would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise, lighting, and visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit.

The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 4, the BDCP would avoid and minimize the potential for significant impacts on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 4 would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally inundated floodplain restoration is the only covered activity expected to result in periodic inundation of riparian brush rabbit habitat. This activity would periodically inundate approximately 264 acres of riparian habitat (9% of riparian habitat in the Plan Area) and 423 acres of associated grassland habitat (14% of associated grassland habitat in the Plan Area) for the riparian brush rabbit. The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of high-value habitat for the species: although they consist of small patches and narrow bands of riparian vegetation, many of these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The restored floodplain would include a range of elevations from lower lying areas that flood frequently (e.g., every 1 to 2 years) to higher elevation areas that flood infrequently (e.g., every 10 years or more).

Seasonal flooding in restored floodplains can result in injury or mortality of individuals if riparian brush rabbits occupy these areas and cannot escape flood waters. One recorded occurrence of riparian brush rabbit (Williams et al. 2002), just west of Stewart Road in Mossdale, is in the area that would be seasonally flooded based on the hypothetical restoration footprint.

NEPA Effects: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 4, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, Alternative 4 would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The overall effect of seasonal inundation on existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for covered riparian species, such as the riparian brush rabbit. Long-term management of riparian areas would ensure that refugia also exist along the edges of seasonally inundated habitat.

The significant impacts of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 4, including AMM1–AMM7, AMM10, AMM25, and

AMM37, would not be expected to result in significant impacts on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Periodic inundation of riparian and grassland habitat for riparian brush rabbit under Alternative 4 would have a less-than-significant impact on the species.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the BDCP area in CZ 7, south of State Route 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; Williams 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47).

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of riparian woodrat modeled habitat as indicated in Table 12-4-56. Tidal habitat restoration, floodplain restoration, and protection and management of natural communities could affect modeled riparian woodrat habitat. However, because the species is not known to occur in the study area it is not expected to be affected by BDCP actions unless the species were to establish in the study area over the term of the BDCP. Full implementation of Alternative 4 would also include biological objectives over the term of the BDCP to benefit the riparian woodrat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian woodrat involves providing opportunities for population expansion into the Plan Area from adjacent lands to the south and southeast. The strategy focuses on restoring and maintaining suitable habitat at the southernmost end of CZ 7, providing connectivity with existing populations to the south and southeast, and creating and maintaining flood refugia. This conservation approach is consistent with the recovery plan (U.S. Fish and Wildlife Service 1998) and conservation principles (see Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*, of the BDCP). The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM5, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain 300 acres riparian habitat in CZ 7 that meets the ecological requirements of the riparian woodrat (i.e., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat (Objective RW1.1, associated with CM3, CM7, CM11).
- Provide and maintain high-water refugia in the 300 acres of riparian woodrat habitat restored under Objective RW1.1 through the retention, construction, and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 67 feet (Objective RW1.2, associated with CM7 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian woodrat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-56. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Riparian	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Riparian	0	51	0	33	0	203
Total Impacts CM2–CM18		**0**	**51**	**0**	**33**	**0**	**203**
TOTAL IMPACTS		**0**	**51**	**0**	**33**	**0**	**203**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

Alternative 4 conservation measures would result in the permanent loss of up to 51 acres of habitat and temporary loss of up to 33 acres of modeled habitat for riparian woodrat (Table 12-4-56). Construction of Alternative 4 water conveyance facilities (CM1) would not affect modeled habitat; however, tidal natural communities restoration (CM4) and seasonally inundated floodplain restoration (CM5) would remove habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled habitat for the riparian woodrat in CZ 7. This habitat is of low value, consisting of a small, isolated patch surrounded by agricultural lands, and the species has a relatively low likelihood of being present in these areas. The measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian woodrat as determined by presence/absence surveys. Because the estimates of habitat loss due to tidal inundation are based on projections of where restoration may occur, actual habitat loss is expected to be lower because sites would be selected to minimize effects on riparian woodrat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 41 acres of modeled habitat for the riparian woodrat in CZ 7. The value of this habitat for riparian woodrat is moderate. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have been detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River. There are two species occurrences immediately south of CZ 7, one of which is less than 1.5 mile from the southernmost patch of riparian habitat potentially affected by levee construction.

  The final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis. However, monitoring and adaptive management described in *CM11 Natural Communities Enhancement and Management.* And AMM25 would ensure that riparian woodrat habitat permanently removed does not exceed the amount estimated based on the hypothetical footprint. Habitat loss is expected to be lower than 41 acres because sites would be selected and restoration designed to minimize effects on the riparian woodrat. If natural flooding is insufficient to maintain appropriate riparian woodrat vegetation structure, the vegetation would be actively managed to provide suitable habitat structure as described in *CM11 Natural Communities Enhancement and Management.*

  Levee construction would also result in the temporary removal of 33 acres of modeled habitat for the riparian woodrat. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian woodrat habitat. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian woodrat habitat and are expected to result in overall improvements to and maintenance of riparian woodrat habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: The only ongoing effects on the riparian woodrat are those potentially resulting from habitat enhancement and management activities. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities may result in harassment of riparian woodrats through noise and visual disturbance which would be minimized with implementation of AMM1–AMM7, AMM10, and AMM25.
- Injury and direct mortality: Water conveyance facility construction is not likely to result in injury or mortality of individual riparian woodrats because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP *Appendix 3.E, Conservation Principles for the Riparian Woodrat and Riparian Brush Rabbit*). Tidal natural communities restoration would not result in injury or mortality of riparian woodrats because, under AMM25, tidal natural communities restoration projects would be designed to avoid occupied riparian woodrat habitat and if that is not possible to trap and relocate the species. Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats; however, preconstruction surveys, construction monitoring, and other measures would be implemented under AMM25 to avoid and minimize injury or mortality of this species during construction, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. If occupied riparian woodrat habitat cannot be avoided, mortality would be avoided through implementation of a trapping and relocation program. The program would be developed in coordination with USFWS, and relocation would be to a site approved by USFWS prior to construction activities.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

No riparian woodrat habitat would be lost in the near-term timeframe. Implementation of CM11 could have minor adverse effects on available riparian woodrat habitat, and activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (see Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be not be adverse under NEPA, because no riparian woodrat habitat would be lost and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 4 as a whole would result in the permanent loss and temporary removal of 84 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (CM3) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period to offset early riparian losses.

The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 4 conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

***NEPA Effects*:** Alternative 4 would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrat should they occupy study area habitats. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have an adverse effect on riparian woodrat under Alternative 4.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes.

No riparian woodrat habitat would be lost in the near-term timeframe. Implementation of CM11 could have minor significant impacts on available riparian woodrat habitat, and activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats.

The BDCP has committed to near-term restoration of 800 acres of riparian habitat (Objective VFRNC1.1) and protection of 750 acres of riparian habitat (Objective VFRNC1.2) (see Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. The Plan also contains commitments to implement AMM1–AMM7, AMM10, and AMM25, which include elements that avoid or minimize the risk of affected habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA, because no riparian woodrat habitat would be lost and there is only limited potential for minor significant impacts on woodrats or its habitat from implementation of CM11. No mitigation would be required.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 4 as a whole would result in the permanent loss and temporary removal of 84 acres of modeled habitat for riparian woodrat habitat during the late long-term. None of this habitat is considered occupied.

Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (CM3) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The Plan would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 4 conservation measures is not expected to significantly impact the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

Alternative 4 would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrat should they occupy study area habitats. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals under Alternative 4 would not have a significant impact on riparian woodrat. No mitigation would be required.

Impact BIO-156: Indirect Effects of Plan Implementation on Riparian Woodrat

Noise, lighting, and visual disturbance adjacent to construction activities could indirectly affect the use of modeled habitat for riparian woodrat. These effects are related construction activities associated with tidal natural communities restoration construction and construction of setback levees. Indirect effects on the species from construction associated with tidal natural communities restoration are unlikely because, under AMM25, tidal natural communities restoration projects would be sited to avoid areas occupied by riparian woodrat. The activity most likely to result in noise, lighting, and visual disturbance to riparian woodrat would be the construction of setback levees. These adverse effects would be minimized through implementation of AMM1–AMM7, AMM10, and AMM25.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 4 would avoid the potential for substantial adverse effects on riparian woodrats, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Therefore, indirect effects of Alternative 4 would not have an adverse effect on riparian woodrat.

CEQA Conclusion: Should the species be detected in the study area, indirect effects of conservation measure construction and implementation could impact riparian woodrat and its habitat. AMM1–AMM7, AMM10, and AMM25 implemented under Alternative 14 would avoid and minimize the impact and result in a less-than-significant impact. No mitigation would be required.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian woodrat habitat. Floodplain restoration would result in periodic inundation of up to 203 acres of riparian woodrat habitat (9% of the riparian woodrat habitat in the Plan Area). The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of moderate-value habitat for the species. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River and there are two species occurrences immediately south of CZ 7, one of which is less than 1 mile from the southernmost patch of riparian habitat potentially affected by levee construction. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more).

NEPA Effects: Alternative 4's period inundation of 203 acres of riparian habitat for riparian woodrat is Alternative 4 not expected to result in substantial adverse effects on riparian woodrat, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrat. The effects of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation. Therefore, the periodic inundation of riparian woodrat habitat would not adversely affect the species under Alternative 4.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect a total of 203 acres of riparian habitat for riparian woodrat, representing 9% of the 2,166 acres of modeled riparian woodrat habitat in the study area. The impact of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation, as described in AMM25. Implementation of CM5 would not be expected to result in significant impacts on riparian woodrat, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Periodic inundation of riparian woodrat habitat under Alternative 4 would have a less-than-significant impact. No mitigation would be required.

Salt Marsh Harvest Mouse

The habitat model used to assess effects for the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Construction and restoration associated with Alternative 4 conservation measures would result in effects on modeled salt marsh harvest mouse habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-4-57. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of

Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit salt marsh harvest mouse (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4).
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary salt marsh harvest mouse habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect and enhance at least 1,500 acres of managed wetland in Grizzly Island Marsh Complex for the benefit of salt marsh harvest mouse (Objective MWNC1.1, associated with CM3).
- Protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3 and CM8).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of restored or created middle and high marsh as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective SMHM1.1).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of managed wetland protected and enhanced in the Grizzly Island Marsh Complex as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California, and increase population levels above the current baseline (Objective SMHM1.2).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs to minimize potential effects, impacts on the salt marsh harvest mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-57. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	TBEW Primary	64	67	0	0	0	0
	TBEW Secondary	0	0	0	0	0	0
	Upland Secondary	8	9	0	0	0	0
	MW Wetland Primary	1,913	5,323	0	0	0	0
	MW Wetland Secondary	315	807	0	0	0	0
	MW Upland	165	762	0	0	0	0
Total Impacts CM2–CM18		**2,465**	**6,968**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**2,645**	**6,968**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. Yolo periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

TBEW = tidal brackish emergent wetland
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

BDCP tidal restoration (CM4) would be the only conservation measure resulting in effects on salt marsh harvest mouse habitat. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 6,968 acres of salt marsh harvest mouse modeled habitat, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. Salt marsh harvest mouse may be displaced temporarily from areas of converted habitat but these areas would ultimately provide suitable habitat for the species. However, 1,058 of these acres would be downgraded from primary habitat (67 acres of primary tidal brackish emergent wetland and 991 acres of primary managed wetland) to secondary tidal brackish emergent wetland. The hypothetical restoration footprints in Suisun Marsh overlap with 13 CNDDB records for salt marsh harvest mouse (California Department of Fish and

Wildlife 2013); however, the BDCP's conservation actions assume that all suitable habitat in Suisun Marsh is occupied by the species.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 1,500 acres of tidal brackish emergent wetland would be managed to provide viable habitat for salt marsh harvest mouse and the protection of 1,500 acres of managed wetland specifically to be managed for salt marsh harvest mouse. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas for salt marsh harvest mouse and may result in localized ground disturbances that could temporarily remove small amounts of salt marsh harvest mouse habitat. The restoration of tidal brackish emergent wetlands, the protection managed wetlands, and the protection and/or restoration of grasslands within 200 feet of restored salt marsh harvest mouse habitat would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of salt marsh harvest mouse habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to salt marsh harvest mouse during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMM listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. The Plan would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be from primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands, as noted in the specie's draft recovery plan, because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under Alternative 4 would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- Restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs. This phasing would ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process, and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (see Chapter 3, Section 3.3.7.13, *Salt Marsh Harvest Mouse*, and Section 3.6, *Adaptive Management and Monitoring Program*, of the BDCP).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level effects on salt marsh harvest mouse resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 4 as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. This loss and conversion would affect 20% of the modeled habitat in the study area. Most of these effects (99%) would be on managed wetlands, which, though are known to be occupied by salt marsh harvest mouse, are at high risk of catastrophic flooding and have a lower long-term conservation value than tidal wetlands (U.S. Fish and Wildlife Service 2010). Effects on up to 20% of the species' habitat in the Plan Area may diminish the salt marsh harvest mouse population in the Plan Area and result in reduced genetic diversity, thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas.

The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process, and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (see Chapter 3, Section 3.3.7.13, *Salt Marsh Harvest Mouse*, and Section 3.6, *Adaptive Management and Monitoring Program*, of the BDCP).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

NEPA Effects: In the absence of other conservation actions, the effects on salt marsh harvest mouse habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place during construction activity. Considering these commitments, losses and conversions of salt marsh harvest mouse habitat and potential mortality of individuals in the near-term and late long-term under Alternative 4 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would be less than significant under CEQA. The Plan would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be to primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse). Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse are listed below.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary impacts under Alternative 4 would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.
- To ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process, and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (see Chapter 3, Section 3.3.7.13, *Salt Marsh Harvest Mouse*, and Section 3.6, *Adaptive Management and Monitoring Program*, of the BDCP).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level impacts on salt marsh harvest mouse resulting from CM1, the analysis of the impacts of conservation actions does not include a comparison with standard ratios used for project-level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, and AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work

areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 4 as a whole would result in effects on 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (Objectives TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (Objectives SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process, and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (see Chapter 3, Section 3.3.7.13, *Salt Marsh Harvest Mouse*, and Section 3.6, *Adaptive Management and Monitoring Program*, of the BDCP).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

Alternative 4 would result in substantial modifications to salt marsh harvest mouse habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on salt marsh harvest mouse.

Impact BIO-159: Indirect Effects of Plan Implementation on Salt Marsh Harvest Mouse

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to salt marsh harvest mouse occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on salt marsh harvest mouse.

Tidal marsh restoration has the potential to increase salt marsh harvests mouse's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High tidal marsh is considered to be primary habitat for salt marsh harvest mouse and thus the species could be exposed to methyl mercury in tidal restoration areas. Salt marsh harvest mouse may be exposed to elemental mercury by feeding on pickleweed, which is found concentrated in the distal tips of pickleweed leaves (Yee et.

al., 2008). Though elemental mercury is less bioavailable than methylmercury, studies have shown that mercury can become methylated in the anaerobic portions of the intestinal tract (Rudd et al. 1980, Rieder et al. 2013) and could thus become a pathway for salt marsh harvest exposure to methylmercury. A study of small mammals residing in pickleweed around the San Francisco Bay showed an absence of salt marsh harvest mouse where mercury concentrations measured in house mice (*Mus musculus*) livers were ≥0.19 µg/g (dry weight) (Clark et al. 1992). Clark et al (1992) also report that the lack of salt marsh harvest mouse at these locations are not the result of undetected habitat differences or are by chance. Clarke et al (1992) suggest that the absence of salt marsh harvest mouse at certain locations may be associated with higher amounts of mercury and polychlorinated biphenyls (PCBs); however, because their study didn't analyze contaminants in salt marsh harvest mouse and because (at that time) there was no data in the literature on contaminants in harvest mice, they could not make conclusions on these associations. Currently, it is unknown what the exact exposure pathways are or what tissue concentrations are harmful to the salt marsh harvest mouse.

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. As discussed in Appendix 11F *Substantive BDCP Revisions*, managed wetlands provide for the highest rates of methylation (Windham-Myers et al. 2010). Thus, restoration actions in Suisun Marsh that convert managed to unmanaged tidal wetlands are expected to decrease mercury methylation on a local scale, and total bioavailable methylmercury on a broader scale in the Suisun Marsh system. Overall, BDCP restoration actions should result in a net benefit to Suisun Marsh in terms of mercury. The potential for salt marsh harvest mouse exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* (as revised in Appendix 11F) includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on salt marsh harvest mouse resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 4 would avoid and minimize indirect effects on salt marsh harvest mouse. These AMMs would also avoid and minimize effects that could substantially reduce the number of salt marsh harvest mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on salt marsh harvest mouse.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact salt marsh harvest mouse within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment adjacent to salt marsh harvest mouse habitat could also impact the species. With implementation of AMM1–AMM5 and AMM26 as part of Alternative 4 construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on salt marsh harvest mouse, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse. The indirect effects of Alternative 4 would have a less-than-significant impact on salt marsh harvest mouse.

Salt marsh harvest mouse could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse, and, therefore, would have a less-than-significant impact on the species.

Suisun Shrew

This section describes the effects of Alternative 4, including water conveyance facilities construction and implementation of other conservation components, on the Suisun shrew. Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model.

Construction and restoration associated with Alternative 4 conservation measures would result in effects on modeled Suisun shrew habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-4-58. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP to benefit Suisun shrew (see Chapter 3, *Conservation Strategy*, of the BDCP).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary Suisun shrew habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (TBEWNC2.1).
- Protect or restore grasslands adjacent t restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area, which provides refugia during high tides (GNC1.4, associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, impacts on the Suisun shrew would not be adverse for NEPA purposes and would be less than significant for CEQA purposes under Alternative 4.

Table 12-4-58. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	Primary	58	60	0	0	0	0
	Secondary	47	342	0	0	0	0
Total Impacts CM2–CM18		**105**	**401**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**105**	**401**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun Shrew

BDCP tidal restoration (CM4) would be the only conservation measure resulting in loss of habitat to Suisun shrew. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects on 401 acres of Suisun shrew modeled habitat, which would include 377 acres of permanent losses and 24 acres of habitat conversions. Suisun shrew may be displaced temporarily from areas of converted habitat but would ultimately provide suitable habitat for the species. However, all 24 acres would be converted from secondary to primary habitat and therefore over would be a net benefit to the species. The hypothetical restoration footprints overlap with two CNDDB records for Suisun shrew (California Department of Fish and Wildlife 2013).
- *CM11 Natural Communities Enhancement and Management*: As described in the BDCP, the restoration of at least 6,000 acres of tidal brackish emergent wetland would be managed to provide habitat for covered species, including Suisun shrew. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas may result in localized ground disturbances that could temporarily remove small amounts of Suisun shrew habitat. The areas of grasslands that would be protected and/or restored within 200 feet of restored tidal marsh would also have enhancement and management actions that would include invasive species control, nonnative

wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of Suisun shrew habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to Suisun shrew during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMM listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. The Plan would affect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects on Suisun shrew.

Other factors relevant to effects on Suisun shrew are listed here.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near-term (2,000 acres) would greatly exceed the amount permanently lost (105 acres).

Because there would be no project-level effects on Suisun shrew resulting from CM1, the analysis of the effects of conservation actions does not include a comparison with standard ratios used for project-level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention*

Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, and AMM26 Salt Marsh Harvest Mouse and Suisun Shrew. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 4 as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area).

The Plan contains a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

***NEPA Effects*:** In the absence of other conservation actions, the effects on Suisun shrew habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of Suisun shrew habitat and potential mortality of individuals under Alternative 4 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would be less than significant under CEQA. The Plan would affect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet would likely benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects on Suisun shrew.

Other factors relevant to impacts on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) would greatly exceed the amount permanently lost (105 acres).

Because there would be no project-level impacts on Suisun shrew resulting from CM1, the analysis of the impacts of conservation actions does not include a comparison with standard ratios used for project-level CEQA analyses.

The Plan also includes commitments to implement AMM1–AMM5 and AMM26. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA. No mitigation would be required.

Late Long-Term Timeframe

The study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 4 as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan contains a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objective TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew include:

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

Alternative 4 would result in substantial modifications to Suisun shrew habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period, Alternative 4 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on Suisun shrew. No mitigation would be required.

Impact BIO-161: Indirect Effects of Plan Implementation on Suisun Shrew

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to Suisun shrew occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect Suisun shrew and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on Suisun shrew.

Tidal marsh restoration has the potential to increase Suisun shrew's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High and mid tidal marsh is considered to be primary habitat for Suisun shrew and thus the species could be exposed to methylmercury in tidal restoration areas. Suisun shrew could be exposed to methylmercury by feeding on marsh invertebrates that may bioaccumulate methylmercury from marsh sediments. Toxic concentrations of methylmercury have been found in the kidneys of shrews that inhabit contaminated sites and forage on earthworms and other prey that live within contaminated sediments (Talmage and Walton 1993; Hinton and Veiga 2002).

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for Suisun shrew exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on Suisun shrew resulting from BDCP tidal restoration.

***NEPA Effects*: **Implementation of the AMMs listed above as part of implementing Alternative 4 would avoid and minimize the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of Suisun shrew, or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on Suisun shrew.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact Suisun shrew within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact Suisun shrew and its habitat. The inadvertent discharge of sediment adjacent to Suisun shrew habitat could also impact the species. With implementation of AMM1–AMM5, and AMM26 as part of Alternative 4 construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew. The indirect effects of Alternative 4 would have a less-than-significant impact on Suisun shrew.

Suisun shrew could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew, and, therefore, would have a less-than significant impact on the species. No mitigation would be required.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10. The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013) reports twelve occurrences of San Joaquin kit foxes along the extreme western edge of the Plan Area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay. Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-4-59). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin San Joaquin kit fox habitat and potential American badger habitat. Full implementation of Alternative 4 would also include biological objectives over the term of the BDCP to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the Plan Area; and providing connectivity to habitat outside the Plan Area. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in CZ 1, CZ 8, and/or CZ 11 (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration) (Objective VPNC1.2, associated with CM3 and CM9).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.4, associated with CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.4, associated with CM11).

- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.5, associated with CM11).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-59. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT	Periodic[d] CM2	Periodic[d] CM5
CM1	Modeled Habitat	258	258	68	68	NA	NA
Total Impacts CM1		258	258	68	68	**NA**	**NA**
CM2–CM18	Modeled Habitat	3	8	0	0	0	0
Total Impacts CM2–CM18		**3**	**8**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**261**	**266**	68	68	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 4 conservation measures would result in the permanent and temporary loss combined of 334 acres of modeled habitat for the San Joaquin kit fox (Table 12-4-59). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects are anticipated to be the same as those described for San Joaquin kit fox. Construction of Alternative 4 water conveyance facilities (CM1) and recreation facilities (CM11) would remove habitat. Habitat enhancement and management activities (CM11) could result in local adverse effects on species. In addition, construction vehicle activity could cause injury or mortality of San Joaquin kit foxes and badgers. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 258 acres and the temporary loss of 68 acres of modeled San Joaquin kit fox and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8. There are three San Joaquin kit fox and no American badger occurrences that overlap with the CM1 footprint.

- *CM11 Natural Communities Enhancement and Managemen*t: The creation of recreational trails and recreational staging areas would result in the permanent removal of 8 acres of San Joaquin kit fox modeled habitat and American badger potential habitat. *AMM24 San Joaquin Kit Fox,* would be implemented to ensure that San Joaquin kit fox dens are avoided, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Mitigation Measure BIO-162*: Conduct Preconstruction Survey for American Badger* would be implemented to ensure that American badger dens are avoided.

  Passive recreation in the reserve system could result in disturbance of San Joaquin kit foxes and American badgers at their den site. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox and American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox or American badger populations. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

  The BDCP would require the enhancement and management of these protected existing grasslands and restored grasslands to improve their function as a natural community of plants and wildlife and for associated covered species, including San Joaquin kit fox and American badger. The BDCP also includes actions to improve rodent prey availability.

  However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs and Mitigation Measure BIO-162 listed below. These AMMs and Mitigation Measure BIO-162 would remain in effect throughout the BDCP's construction phase.

- Operations and maintenance: Ongoing maintenance of BDCP facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, AMM24, and AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Under Alternative 4 there would be a loss of 329 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (326 acres) and CM11 (3 acres).

Typical NEPA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3, *Conservation Strategy*, of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 658 acres of grassland should be protected for San Joaquin kit fox to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 658 acres of grassland protected.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, the effects of Alternative 4 would not be adverse with habitat protection, restoration, management, and enhancement in addition to implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation.* AMMs contain elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 334 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger, representing 6% of the modeled habitat.

With full implementation of Alternative 4, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the study area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for both species.

Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1)and to other adjoining San Joaquin kit fox habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A, *Covered Species Accounts*). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

***NEPA Effects*:** In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 4 would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11 and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-162, the effects of Alternative 4 as a whole on San Joaquin kit fox and American badger would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes.

Under Alternative 4 there would be a loss of 329 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (326 acres) and CM11 (3 acres).

Typical CEQA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3, *Conservation Strategy*, of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 658 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding significant impacts of habitat loss on San Joaquin kit fox and American badger. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for San Joaquin kit fox and the mitigation measure for American badger satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 4 would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 4as a whole on San Joaquin kit fox and American badger would be less than significant.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 334 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger.

With full implementation of Alternative 4, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger are most likely to occur if present in the study area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area an estimated 132 acres of restored grasslands would be suitable for the species.

Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1) and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 includes 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in

Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*, of the BDCP) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 4 would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place during all project activities, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 4 as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project-related conservation areas within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Plan Implementation on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San

Joaquin kit fox or badger dens in the vicinity of the conveyance facility, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, if any, and other measures as described in AMM1–AMM6, AMM10, AMM24, AMM37, and Mitigation Measure BIO-162.

NEPA Effects: Implementation of the AMMs listed above Alternative 4 and Mitigation Measure BIO-162 *Conduct Preconstruction Survey for American Badger*, would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on San Joaquin kit fox or American badger.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 4 construction, operation, and maintenance, the BDCP would avoid the potential for significant impacts on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species; therefore, this impact would be less than significant. In addition, Mitigation Measure BIO-162, as described above, would further reduce the potential for indirect effects of Alternative 4 on American badger.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

Habitat for San Joaquin pocket mouse consists of the grassland natural community throughout the Plan Area. The species requires friable soils for burrowing. Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-4-60. Full implementation of Alternative 4 would also include the following conservation actions over the term of the BDCP that would likely benefit San Joaquin pocket mouse.

- Protect 8,000 acres of grasslands (GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grasslands (GNC1.2, associated with CM8).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (GNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, Alternative 4's impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-60. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 4 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Grassland	467	467	158	158	NA	NA
Total Impacts CM1		**467**	**467**	**158**	**158**	**NA**	**NA**
CM2–CM18	Grassland	889	2,057	239	273	385–1,277	514
Total Impacts CM2–CM18		**889**	**2,057**	**239**	**273**	**385–1,277**	**514**
TOTAL IMPACTS		**1,356**	**2,524**	**397**	**431**	**385–1,277**	**514**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. Yolo periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 4 conservation measures would result in the combined permanent and temporary loss of up to 2,955 acres of habitat for San Joaquin pocket mouse, of which 2,524acres would be a permanent loss and 431 acres would be a temporary loss of habitat (Table 12-4-60). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool Natural Community and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Community Enhancement and Management*, and *CM18 Conservation Hatcheries*. The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the combined permanent and temporary loss of up to 625 acres of potential San Joaquin pocket mouse habitat (467 acres of permanent loss, 158 acres of temporary loss) in CZ 3–CZ 6 and CZ 8. The majority of grassland that would be removed would be in CZ 8, from the modifications to Clifton Court Forebay. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4 construction locations. Construction of the forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Wildlife 2013).

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement (CM2) would permanently remove 388 acres of potential San Joaquin pocket mouse habitat in the Yolo Bypass in CZ 2. In addition, 239 acres would be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 1,122 acres of potential San Joaquin pocket mouse habitat. The majority of the losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment remaining grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 85 acres of San Joaquin pocket mouse habitat (51 permanent, 34 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would impact 410 acres of grasslands, primarily in CZ 7, as part of tidal natural communities restoration (11 acres) and seasonal floodplain restoration (399 acres).

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Up to 10 acres of grassland would be permanently converted to vernal pool complex. The vernal pool and alkali seasonal wetland restoration would leave intact the grasslands surrounding the vernal pools. Temporary construction-related disturbance of grassland habitat would result from implementation of *CM9* in CZ 1, CZ 8, and CZ 11. However, all areas would be restored to their original or higher value habitat after the construction periods.

- *CM11 Natural Communities Enhancement and Management:* The creation of recreational trails and recreational staging areas would result in the permanent removal of 50 acres of grassland. The protection of 8,000 acres of grassland for covered species is expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.

  A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. With full implementation Alternative 4, enhancement and management actions designed for western burrowing owl would also be expected to benefit San Joaquin pocket mouse. San Joaquin pocket mouse would benefit particularly from protection of grassland habitat against potential loss or degradation that otherwise could occur with future changes in existing land use.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of San Joaquin pocket mouse habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. The Plan would remove 1,753 acres of San Joaquin pocket mouse habitat (1,356 permanent, 397 temporary) in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 625 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Riparian Natural Community Restoration (CM7), Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], Natural Community Enhancement and Management – Recreation Facilities (CM11), and Conservation Hatcheries [CM18] 1,128 acres).

Typical NEPA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,250 acres of grassland natural communities should be protected to mitigate the CM1 losses of 625acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of San Joaquin pocket mouse habitat using the same typical NEPA ratios (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, 2, 4, 5, 7, 8, and 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 especially considering that a large portion of the impacts to grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containments and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 2,955 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, CZ 8, and CZ 11 (Objective GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area)(Objective GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

NEPA Effects: In the near-term, the loss of San Joaquin pocket mouse habitat and potential for direct mortality would not be an adverse effect because the BDCP has committed to protecting and restoring an acreage that would meet the typical mitigation ratios described above. In the absence of other conservation actions, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 4 would represent an adverse effect in the late long-term. However, the BDCP has committed to habitat protection and restoration associated with CM3, CM8, and CM11. This habitat protection and restoration would be guided by biological goals and objectives and by AMM1–AMM6 and AMM10, which would be in place during construction. Considering these commitments, losses of San Joaquin pocket mouse and potential mortality under Alternative 4 would not be an adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. The Plan would remove 1,753 acres of modeled (1,356 permanent, 397 temporary) habitat for San Joaquin pocket mouse in the study area in the near-term. One record of San Joaquin pocket mouse near Clifton Court forebay could be affected by the construction of the new forebay. These effects would result from the construction of the water conveyance facilities (CM1, 625 acres), and implementing other conservation measures (Yolo Bypass Fisheries Enhancement [CM2] Tidal Natural Communities Restoration [CM4], Seasonally Inundated Floodplain Restoration [CM5], Riparian Natural Community Restoration (CM7), Grassland Natural Community Restoration [CM8], Vernal Pool and Alkali Seasonal Wetland Complex Restoration [CM9], Natural Community Enhancement and Management – Recreation Facilities (CM11), and Conservation Hatcheries [CM18] 1,116 acres).

Typical CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,250 acres of grassland natural communities should be protected to mitigate the CM1 losses of 625 acres of San Joaquin pocket mouse habitat.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 especially considering that a large portion of the impacted grasslands consists of thin strips of grassland along levees and that areas of grassland protection and restoration would be in large contiguous blocks.

The Plan also includes commitments to implement AMM1–AMM6, and AMM10. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 4 would be less than significant under CEQA. No mitigation would be required.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 4 as a whole would result in the permanent loss of and temporary effects on 2,955acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 2,000 acres of grassland in CZ 1, 8 and 11 (Objective GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 in the study area) (Objective GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (Objective GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM6 and AMM10, the loss of habitat or direct mortality through implementation of Alternative 4 would not result in a substantial significant impact through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Impact BIO-165: Indirect Effects of Plan Implementation on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat over the term of the BDCP. These potential effects would be minimized and avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the plan's construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

NEPA Effects: Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on San Joaquin pocket mouse.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6, and AMM10, as part of Alternative 4 construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse. No mitigation would be required.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (see Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, for details on methods and results, and Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*).

The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat, at the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. Biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Construction and restoration associated with Alternative 4 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-4-61. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. The conservation measures that would be implemented to achieve the biological goals and objectives that would also benefit special-status bats are summarized below.

- Protect or restore 142,200 acres of high-value natural communities (Objective L1.1, associated with CM3). This objective involves protecting and restoring a variety of habitat types described below (see Table 3.3-1 in Chapter 3, *Conservation Strategy*, of the BDCP).
  - Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
  - Protect 600 acres of existing vernal pool complex (Objective VPNC1.1, associated with CM3).
  - Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
  - Protect 8,100 acres of managed wetland (Objective MWNC1.1, associated with CM3 and CM11).
  - Protect 48,625 acres of cultivated lands (Objective CLNC1.1, associated with CM3 and CM11).
  - Protect, restore, or create 2,740 acres of rice land or equivalent habitat type for the giant garter snake (Objective GGS3.1, associated with CM3, CM4, and CM10).
  - Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
  - Restore 67 acres of vernal pool complex (Objective VPNC1.2, associated with CM3 and CM9).
  - Restore and protect 65,000 acres of tidal natural communities (Objective L1.2, associated with CM2 – CM4).
  - Restore or create 5,000 acres of valley/foothill riparian natural community (Objective VFRNC1.1, associated with CM3 and CM7).
  - Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4-61. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 4[a]

Conservation Measure[b]	Habitat Type[c]	Permanent NT	Permanent LLT[d]	Temporary NT	Temporary LLT	Periodic[e] CM2	Periodic[e] CM5
CM1	Roosting	64	64	200	200	NA	NA
	Foraging	4,496	4,496	3,459	3,459	NA	NA
Total Impacts CM1		**4,560**	**4,560**	**3,659**	**3,659**	**NA**	**NA**
CM2–CM18	Roosting	524	1,570	167	212	324	411
	Foraging	14,497	60,399	773	2,126	21,265	10,137
Total Impacts CM2–CM18		**15,021**	**61,696**	**940**	**2,338**	**21,589**	**10,548**
TOTAL IMPACTS		**19,581**	**66,256**	**4,599**	**5,997**	**21,589**	**10,548**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Affected roosting habitat acreages include valley foothill riparian habitat, developed lands, and orchards. An unknown number of buildings, bridges, tunnels, and individual trees could also be affected but were not included in this analysis. Foraging habitat includes all natural communities, cultivated lands, and developed lands in the study area. Foraging habitat effects for CM2-CM18 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands).

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 4 conservation measure CM1 would result in the permanent and temporary loss combined of up to 264 acres of roosting habitat and 7,955 acres of foraging habitat for special-status bats in the study area. DWR identified two bridges as potential night roosting habitat that could be affected by construction in CM1. Conservation measures Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5) would result in the permanent and temporary loss of 1,782 acres of roosting habitat and the conversion of approximately 65,525 acres of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Habitat enhancement and management activities (CM11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect special-status bat habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 4 conveyance facilities would result in the permanent loss of approximately 64 acres of roosting habitat and 4,4,96 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 200 acres of roosting habitat and up to 3,459 acres of foraging habitat for special-status bats in the study area (Table 12-4-61). DWR identified two bridges with potential night roosting habitat in the forebay embankment area and tunnel muck area that could be permanently affected by construction for CM1. Additional roosting habitat affected by construction and operations includes valley/foothill riparian natural community, developed lands, and landscaped trees, including eucalyptus, palms and orchards.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the conversion of approximately 2,025 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM2 would also result in the permanent removal of 89 acres and temporary removal of 167 acres of roosting habitat for special-status bats. The maternity colony of Mexican free-tailed bats located at both ends of the Yolo Causeway Bridge could also be affected during construction for CM2. Implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would ensure that improvements in the Yolo Bypass avoid effects on roosting special-status bats.
- C*M4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of approximately 56,810 acres of foraging habitat into wetlands that could still be used by bats for foraging. Approximately 1,425 acres of roosting habitat for special-status bats would permanently affected. This habitat is of low value, consisting of a small, isolated patch surrounded by cultivated lands, and the species have a relatively low likelihood of being present in these areas. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, requires that tidal natural communities restoration avoid effects on roosting special-status bats.
- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the conversion of an estimated 3,690 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM5 would also result in the permanent removal of 57 acres and temporary removal of 45 acres of roosting habitat for special-status bats in the study area.
- *CM11 Natural Communities Enhancement and Management*: Implementation of the plan would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.
- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to conservation components could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat resulting for CM1, CM2, and CM4.

Alternative 4 would permanently or temporarily affect 955 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (264 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Of the 955 acres of affected roosting habitat, 536 acres are valley/foothill riparian habitat. Effects from CM5 would all occur in the late long-term. Most of the roosting habitat losses would occur in a valley/foothill riparian. Typical NEPA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 536 acres of riparian habitat should be restored and 536 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and

Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 4.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these effects.

The BDCP also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 4 as a whole would affect 2,046 acres of roosting habitat (Table 12-4-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale. Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

NEPA Effects: In the near-term, the losses of roosting habitat for special-status bats associated with implementing Alternative 4 are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of roosting habitat for special-status bats, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 4 as a whole on special-status bats would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant for CEQA purposes. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4.

Alternative 4 would permanently or temporarily affect 955 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (264 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Of the 955 acres of affected roosting habitat, 536 acres are valley/foothill riparian habitat. Typical CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 536 acres of riparian habitat should be restored and 536 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the significant impacts resulting from near-term effects from Alternative 4.

In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these impacts to a less-than-significant level.

The permanent loss of roosting habitat from Alternative 4 would be mitigated through implementation of Mitigation Measure BIO-166, which would include protective measures to ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The BDCP also contains commitments to implement AMM1–6 and AMM10. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 4 as a whole would affect 2,046 acres of roosting habitat (Table 12-4-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale. Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have a significant impact on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the significant impacts resulting from late long-term effects from CM1, CM2, CM4, and CM5.

The permanent loss of roosting habitat from Alternative 4 would be mitigated through implementation of Mitigation Measure BIO-166, which would include protective measures to ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications, and no substantial reduction in numbers or a restriction in the range of special-status bats. Therefore, Alternative 4 would not result in a significant impact on special-status bats under CEQA.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined by DWR in consultation with CDFW and shall include, as applicable, the measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.
- Disturbance of the bridge will be avoided between April 15 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bats that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal will be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 31, later tree removal may be considered in consultation with CDFW.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent practicable and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction would be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:
    - Eviction will not occur before September 15th and will match the timeframe for tree removal approved by CDFW.
    - Qualified biologists will carry out or oversee the eviction tasks and monitor the tree trimming/removal.
    - Eviction will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
    - Eviction will take place during weather and temperature conditions conducive to bat activity.
    - Special-status bat roosts would not be disturbed.

    Eviction procedures shall include but are not limited to:

    - Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.

- ○ Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- ○ Noninjurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat will also be determined through consultation with CDFW and may include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, “bat bark,” planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. “Bat bark” has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Plan Implementation on Special-Status Bats

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat over the term of the BDCP.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural communities restoration would potentially indirectly affect special-status bat species. *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *CM12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from BDCP tidal natural communities restoration.

NEPA Effects: Implementation of the Mitigation Measure BIO-166 for special-status bats and *CM12 Methylmercury Management* would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 4 would not have an adverse effect on special-status bats.

CEQA Conclusion: Indirect effects from conservation components operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166 and *CM12 Methylmercury Management* would reduce this impact to a less-than-significant level by implementing protective measures to ensure that Alternative 4 would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 324 acres of roosting habitat and 21,265 acres of foraging habitat for special-status bats in the study area (Table 12-4-61).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate up to 411 acres of roosting habitat and 10,137 acres of foraging habitat for special-status bats (Table 12-4-61). Potential roosting trees are likely to be retained within seasonally flooded areas, although high velocity flooding could uproot some trees. Seasonal flooding would not adversely affect foraging habitat for the species. The overall effect of seasonal inundation in existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for special-status bats that use riparian habitats.

NEPA Effects: The periodic losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 4 are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address any effects of periodic inundation on special-status bats and roosting habitat. Therefore, Alternative 4 would not adversely affect the species.

CEQA Conclusion: Periodic inundation under CM2 and floodplain restoration under CM5 would periodically affect foraging and roosting habitat for special-status bats in the study area, which could result in a significant impact. Any impact of periodic inundation on special-status bats would be mitigated through implementation of Mitigation Measure BIO-166, which would include protective measures to ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Plant Species

Vernal Pool Species

Five covered plant species and 12 noncovered special-status plant species occur in vernal pools in the study area (Tables 12-2 and 12-3, summarized in Table 12-4-62). The vernal pool habitat model used for the impact analysis on vernal pool species was based on vegetation types and associations from various data sets which were used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which these species are known to occur, including vernal pool complex, degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 4.

Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit covered vernal pool plant species (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect at least two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Objective VPP1.1, associated with CM3).
- Maintain no net loss of Heckard's peppergrass in Conservation Zones 1, 8, or 11 within restoration sites or within the area of affected tidal range of restoration projects (Objective VPP1.2, associated with CM3 and CM9).

The construction and restoration activities covered under Alternative 4 could have impacts on special-status vernal pool plant species. Modeled habitat is within the proposed footprint for the Alternative 4 water conveyance facilities and within the hypothetical footprint for restoration activities. One known occurrence of a covered plant species is within the proposed footprint for the Alternative 4 water conveyance facilities. Table 12-4-62 summarizes the acreage of modeled vernal pool habitat in the study area and the number of occurrences of each special-status vernal pool species in the study area.

1 **Table 12-4-62. Summary of Impacts on Vernal Pool Plant Species under Alternative 4**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Vernal pool complex	9,557	13	–	–	Habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Degraded vernal pool complex	2,576	377	–	–	Habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Alkali Seasonal Wetland	188	1	–	–	Habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Total	12,321	391	–	–	Habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Covered Species					
Alkali milk-vetch	–	–	16	1	Population loss from construction of the water conveyance facilities
Dwarf downingia	–	–	12	0	None
Boggs Lake hedge-hyssop	–	–	1	0	None
Legenere	–	–	8	0	None
Heckard's peppergrass	–	–	4[a]	0	None
Noncovered Species					
Ferris' milk-vetch	–	–	6	0	None
Vernal pool smallscale	–	–	2	0	None
Hogwallow starfish	–	–	0	0	None
Ferris' goldfields	–	–	4	0	None
Contra Costa goldfields	–	–	7	0	None
Cotula-leaf navarretia	–	–	5	0	None
Baker's navarretia	–	–	3	0	None
Colusa grass	–	–	1	0	None
Bearded popcorn-flower	–	–	4	0	None
Delta woolly marbles	–	–	3	0	None
Saline clover	–	–	9	0	None
Solano grass	–	–	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

2

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Under Alternative 4, conservation measures would affect habitat for special-status vernal pool species and one occurrence of a noncovered vernal pool species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Twenty-three acres of modeled vernal pool habitat, 19.4 acres of critical habitat for Contra Costa goldfields, and one known occurrence of the 17 vernal pool species are within the proposed footprint for the Alternative 4 water conveyance facilities. One occurrence of alkali milk-vetch in CZ 8 would be crossed by an electric transmission line. Under Alternative 4, construction and operation of the water conveyance facilities could affect undiscovered occurrences of the five covered vernal pool species or the 12 noncovered special-status species.

  The east-west transmission line would not affect four covered vernal pool species that occur in the study area. One occurrence each of dwarf downingia, legenere, Heckard's peppergrass, and Boggs Lake hedge-hyssop are within the east-west transmission line study area. However, the transmission line would not cross any of the occurrences.

- *CM2 Yolo Bypass Fisheries Enhancement*: No modeled vernal pool habitat and no known occurrences of the 17 vernal pool plant species are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of CM2 would not affect the 17 covered or noncovered vernal pool species.

- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit covered vernal pool species by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1). The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species. These benefits also would accrue to any noncovered vernal pool species occurring in the protected vernal pool complex.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would result in the inundation of 372 acres of vernal pool complex and would, therefore, potentially affect special-status vernal pool species. However, most of this habitat (370 acres) consists of degraded vernal pool habitat that is unlikely to contain special-status species. In addition, 257.8 acres of critical habitat for Contra Costa goldfields could be affected. No known occurrences of covered or noncovered vernal pool species would be affected by tidal restoration.

- *CM5 Seasonally Inundated Floodplain Restoration*: No vernal pool habitat or occurrences of special-status vernal pool species are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered vernal pool species.

- *CM6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered vernal pool species.

- *CM7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plant species are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered vernal pool species.

- *CM8 Grassland Natural Community Restoration*: Although the vernal pool complex habitat includes grassland matrix within which the vernal pools occur, grassland restoration activities would take place in nongrasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within vernal pool complex habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered vernal pool plant species.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, BDCP activities result in the net loss of vernal pool habitat, CM9 would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plant species would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool species or affect vernal pool habitat adjacent to the restoration areas.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on covered and noncovered vernal pool plant species.

- *Avoidance and Minimization Measures*: Effects on covered vernal pool plant species potentially resulting from implementation of Alternative 4 would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation.* AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. AMM12 also requires that that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 will not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM30 specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible. AMM37 requires that new recreation trails avoid populations of covered vernal pool plant species. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In addition, the BDCP includes species-specific goals to benefit covered vernal pool plant species. This includes protecting two occurrences of alkali milk-vetch (Objective VPP1.1) and requiring no net loss of Heckard's peppergrass occurrences (Objective VPP1.2).

In summary, no adverse effects on special-status vernal pool plant species would be expected from implementing Alternative 4. Construction of the water conveyance facilities could affect one species, alkali milk-vetch, although adverse effects on this species would be avoided or minimized though implementation of AMM11 and AMM30. No other known occurrences of special-status vernal pool plant species would be affected under Alternative 4. Beneficial effects on special-status vernal pool species could occur by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 and by protecting occurrences of alkali milk-vetch.

The GIS analysis estimated that up to 395 acres of vernal pool complex could be adversely affected by covered activities. However, the actual effect on habitat for special-status vernal pool plant species is expected to be much less than the estimated impact because the BDCP limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool species (Objective VPNC1.2, associated with CM9). This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts. The limitation on the loss of wetted vernal pool habitat will constrain the implementation of tidal restoration projects that are adjacent to vernal pool complex, which could affect the feasibility of restoring 65,000 acres of tidal habitat (Objective TPANC1.1, associated with CM4).

***NEPA Effects*:** The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through CM9, and effects of constructing CM1 on one occurrence of alkali milk-vetch would be avoided through implementation of AMM30. Therefore, Alternative 4 would not result in adverse effects on covered and noncovered vernal pool plant species.

***CEQA Conclusion*:** Because loss of modeled habitat for vernal pool plant species would be offset through restoration, and because impacts on occurrences of covered vernal pool plants would be avoided, implementation of Alternative 4 would not result in a reduction in the range or numbers of 17 covered and noncovered special-status vernal pool species in the study area. Therefore, impacts on covered and noncovered vernal pool plant species would be less than significant. No mitigation is required.

Alkali Seasonal Wetland Species

Five covered species and three noncovered species occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4-63). Alkali seasonal wetland habitat was modeled separately for four covered plant species occurring in seasonal alkali wetlands.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border of the study area. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit covered alkali seasonal wetland species (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Of the 150 acres of alkali seasonal wetland complex protected under Objective ASWNC1.1, 600 acres of vernal pool complex protected under Objective VPNC1.1, and 8,000 acres of grassland natural community protected under Objective GNC1.1, protect 75 acres of suitable brittlescale habitat and 75 acres of suitable heartscale habitat in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.1, associated with CM3).
- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.2, associated with CM3).

Modeled habitat for Delta button-celery would be adversely affected by construction of the Alternative 4 water conveyance facilities. One population of crownscale also would be adversely affected by construction of the water conveyance facilities. Modeled habitat for brittlescale and heartscale could be adversely affected by tidal habitat restoration. One occurrence each of San Joaquin spearscale and Heckard's peppergrass could be affected by tidal habitat restoration. No adverse effects on palmate-bracted bird's-beak or recurved larkspur would be expected. Table 12-4-63 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland species in the study area.

1 **Table 12-4-63. Summary of Impacts on Seasonal Alkali Wetland Plant Species under Alternative 4**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	758	–	–	Habitat loss from construction of water conveyance facilities, construction of Yolo Bypass fisheries enhancements, tidal habitat restoration, and floodplain restoration levee construction
Brittlescale modeled habitat	451	4	–	–	Habitat loss from tidal habitat restoration
Heartscale modeled habitat	6,528	306	–	–	Habitat loss from tidal habitat restoration
Delta button-celery modeled habitat	3,361[a]	96	–	–	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	75	–	–	Habitat loss from construction of water conveyance facilities, tidal restoration and Yolo Bypass Fisheries enhancements
Covered Species					
San Joaquin spearscale	–	–	19	2	Population loss from construction of water conveyance facilities and tidal habitat restoration
Brittlescale	–	–	8	0	None
Heartscale	–	–	3	0	None
Delta button-celery	–	–	1[b]	0	None
Heckard's peppergrass	–	–	1[c]	1	Population loss from tidal habitat restoration
Noncovered Species					
Crownscale	–	–	17	1	Population loss from construction of water conveyance facilities
Palmate-bracted bird's-beak	–	–	1	0	None
Recurved larkspur	–	–	4	0	None

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

2

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Alternative 4 would have adverse effects on modeled habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. It would also have adverse effects on occurrences of San Joaquin spearscale, Heckard's peppergrass, and crownscale.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Under Alternative 4, construction of the Byron Tract Forebay would permanently remove 76 acres of modeled habitat for San Joaquin spearscale and 96 acres of modeled habitat for Delta button-celery. This could be an adverse effect, depending on whether or not the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. One known occurrence of San Joaquin spearscale near the forebay would be affected by facilities construction. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected.

  Construction of the water conveyance facilities would permanently remove about 1.5 acres of habitat occupied by crownscale at the Byron Tract Forebay. All or most of the occurrence would be directly affected.

  Construction of the water conveyance facilities would not affect brittlescale, heartscale, Heckard's peppergrass, palmate-bracted bird's-beak, or recurved larkspur.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass improvements would permanently remove 56 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No modeled habitat and no known occurrences of the seven other alkali seasonal wetland species are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.

- *CM3 Natural Communities Protection and Restoration*: Alternative 4 would benefit alkali seasonal wetland species by protecting 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, and/or 11. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration is expected to convert alkali seasonal wetlands on the margins of tidal wetlands to freshwater or brackish tidal marsh. Tidal habitat restoration would convert 622 acres of modeled habitat for San Joaquin spearscale to tidal marsh. Tidal habitat restoration would permanently remove 4 acres of modeled habitat for brittlescale in CZ 1 near Lindsey Slough and in CZ 11 near Nurse Slough; however, the BDCP would allow up to 50 acres of modeled habitat to be converted to tidal wetlands. Tidal habitat restoration would remove 306 acres of modeled habitat for heartscale in CZ 1 in the vicinity of Jepson Prairie and in CZ 11 adjacent to Suisun Marsh. The extent to which the modeled habitat is actually occupied by these species is not known; modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Tidal habitat restoration could adversely affect an occurrence of Heckard's peppergrass at Hass Slough and an occurrence of San Joaquin spearscale at Main Prairie, both in CZ 1. These occurrences are based on historic records, and the whether or not the populations still exist is not known. In each case, the loss of modeled habitat and occurrences for covered species would be adverse effects. Delta button celery, crownscale, palmate-bracted bird's-beak, and recurved larkspur would not be affected by tidal habitat restoration.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the removal of 2 acres of modeled habitat for San Joaquin spearscale. In addition, 3 acres would be subject to periodic flooding. No known occurrences of San Joaquin spearscale would be affected. No other alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland species are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered alkali seasonal wetland plant species.

- *CM6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland species.

- *CM7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland species.

- *CM8 Grassland Natural Community Restoration*: Although the alkali seasonal wetland habitat includes the grassland matrix within which the wetlands occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within alkali seasonal wetland habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered alkali seasonal wetland species.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plant species. In addition, the BDCP would compensate for the loss of alkali seasonal wetlands resulting from other conservation measures by restoring or creating 72 acres of alkali seasonal wetlands in Conservation Zones 1, 8, or 11 to achieve no net loss of this habitat.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plant species.

- *Avoidance and Minimization Measures*: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of CM1 and CM4 would be avoided or minimized through *AMM2 Construction Best Management Practices and Monitoring, AMM11 Covered Plant Species, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant specie species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of covered species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided with implementation of AMM11. AMM30 requires that transmission line construction avoid any losses of alkali seasonal wetland complex natural community. AMM37 requires that new recreation trails avoid populations of covered alkali seasonal wetland species. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, only one known occurrence of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 4, although one historic occurrence of Heckard's peppergrass and one historic occurrence of San Joaquin spearscale could also be affected by tidal restoration activities, if those occurrences still exist. AMM11 would be implemented to avoid an adverse effect on Heckard's peppergrass and San Joaquin spearscale occurrences.

The primary effect of Alternative 4 on special-status alkali seasonal wetland plant species would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. Approximately 75 acre of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland species is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the BDCP limits the total loss of wetted vernal pool habitat to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex (Objective VPNC1.2, associated with CM9). Approximately 72 acres of alkali seasonal wetlands would be restored (Objective ASWC1.2, associated with CM9). Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis (Objective GNC1.1, associated with CM8). These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

The BDCP would have a small beneficial effect on special-status alkali seasonal wetland plant species by protecting 150 acres of alkali seasonal wetland habitat. The BDCP also includes the species-specific goal that 75 acres of the protected alkali seasonal wetland habitat would be modeled habitat for brittlescale and heartscale (Objective BRIT/HART/SJSC1.1) and another goal that would protect 2 occurrences of San Joaquin spearscale (Objective BRIT/HART/SJSC1.2). The benefits of habitat protection and management also would accrue to any noncovered alkali seasonal wetland species occurring in the protected habitat.

NEPA Effects: Under Alternative 4, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (CM8, CM9), and impacts on one occurrence of San Joaquin spearscale and one occurrence of Heckard's peppergrass would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse. The loss of one occurrence of crownscale, a non-covered species, would result in a reduction in the range and numbers of this species and would be an adverse effect. Adverse effects on crownscale could be avoided or offset through implementation of Mitigation Measure BIO-170.

***CEQA Conclusion*:** Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of covered alkali seasonal wetland species would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 4 would not result in substantially reducing the number or restricting the range of five covered and two noncovered alkali seasonal wetland plant species. However, conservation measures that benefit or protect covered species do not apply to noncovered species, and loss of the crownscale population at Byron Tract Forebay would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level by conducting surveys and implementing measures to avoid, minimize, or compensate for impacts to noncovered special-status plant species.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plant species, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppy and caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered species if feasible. The purpose of these surveys will be to verify that the locations of special-status species identified in previous record searches or surveys are extant, identify any new special-status species occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plant species will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plant species in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of covered fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having noncovered special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasible through the establishment of 250-foot activity exclusion zones surrounding the periphery of occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be established according

to a 250-foot buffer surrounding the periphery of each special-status plant species, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.

- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Grassland Species

One covered plant species and 11 noncovered special-status plant species occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-4-64). The only covered plant species occurring in grassland is Carquinez goldenbush. Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extent of alluvium deposits in close proximity to the actual rivers/streams.

Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit covered grassland species (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect three unprotected occurrences of the Carquinez goldenbush in Conservation Zones 1 and/or 11 (Objective CGB1.1, associated with CM3).
- Maintain and enhance occupied Carquinez goldenbush habitat to slow erosion and reverse degradation from livestock grazing (Objective CGB1.2, associated with CM11).

Of 78,047 acres of grasslands in the study area, Alternative 4 would adversely affect 3,449 acres under Alternative 4, including 4 acres that are modeled habitat for Carquinez goldenbush. For 10 of the plant species, no known occurrences would be affected. One of five Parry's rough tarplant occurrences in the study area could be adversely affected by Alternative 4. Table 12-4-64 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland species in the study area.

Table 12-4-64. Summary of Impacts on Grassland Plant Species under Alternative 4

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	4	–	–	Habitat loss from tidal habitat restoration
Grassland	78,047	3,517	–	–	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass Fisheries enhancements, floodplain restoration, and construction of conservation hatcheries
Covered Species					
Carquinez goldenbush	–	–	10	1	Population loss from tidal restoration
Noncovered Species					
Big tarplant	–	–	5	0	None
Round-leaved filaree	–	–	2	0	None
Pappose tarplant	–	–	7	0	None
Parry's rough tarplant	–	–	5	1	Periodic inundation of one occurrence as a result of Yolo Bypass operations
Small-flowered morning-glory	–	–	0	0	None
Diamond-petaled poppy	–	–	1	0	None
Stinkbells	–	–	1	0	None
Fragrant fritillary	–	–	4	0	None
Gairdner's yampah	–	–	0	0	None
Streamside daisy[a]	–	–	1	0	None
Caper-fruited tropidocarpum	–	–	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified in the BDCP.

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Alternative 4 could have adverse effects on modeled habitat for Carquinez goldenbush. It could also have adverse effects on one occurrence of Carquinez goldenbush and one occurrence of Parry's rough tarplant. Although Alternative 4 would have no expected effects on known occurrences of the other special-status plant species that occur in grasslands, the loss of 3,517 acres of grassland would have the potential to affect undocumented populations of special-status grassland species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland species are within the proposed footprint for the Alternative 4 water conveyance facilities. About 625 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 4, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland species.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 627 acres of grassland habitat. Yolo Bypass operations would result in more frequent and longer inundation of 1,597 acres of grasslands in the Yolo Bypass (CZ 2) that include habitat for one occurrence of Parry's rough tarplant. Parry's rough tarplant is a summer-blooming plant that occurs in areas subject to occasional inundation during the wet season, such as swales and seasonal wetlands. Increasing the frequency or duration of inundation may decrease the distribution in some areas by making some conditions too wet but would also expand the distribution into areas that may currently be too dry. Overall, changing the frequency and duration of inundation in the area of this occurrence should not result in a substantial change in the range of numbers of Parry's rough tarplant. Construction and operation of the Yolo Bypass Fisheries enhancements would not affect modeled habitat for Carquinez goldenbush or known occurrences of other special-status grassland species.
- *CM3 Natural Communities Protection and Restoration*: Alternative 4 would preserve 8,000 acres of grassland habitat, some of which may contain modeled habitat for Carquinez goldenbush. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 1,122 acres of grassland habitat, including 4 acres of modeled habitat for Carquinez goldenbush along the eastern side of Suisun Marsh. One occurrence of Carquinez goldenbush would be partially affected by tidal restoration. No other known occurrences of special-status grassland plants are within the hypothetical footprint of tidal restoration. Therefore, tidal restoration would have impacts on only one known occurrence of special-status grassland species.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of new floodplain levees would result in the loss of 85 acres of grassland habitat, periodic inundation of the floodplain would affect 513 acres of grassland habitat, and another 399 acres of grassland habitat would be converted to riparian habitat. However, no modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for floodplain restoration, and the affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered grassland species.

- *CM6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered grassland species.

- *CM7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered grassland species.

- *CM8 Grassland Natural Community Restoration*: Grassland restoration would restore 2,000 acres of grassland habitat. Restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands. These areas do not currently provide habitat for special-status grassland plants. Therefore, grassland communities restoration would have no impacts on covered and noncovered grassland species.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plants would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland species.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on covered and noncovered grassland species.

- *CM18 Conservation Hatcheries*: Construction of the conservation hatcheries would remove 35 acres of grassland habitat. The removed habitat would consist of ruderal herbaceous vegetation that would not be likely to provide habitat for special-status grassland plants. Therefore, construction of the conservation hatcheries would not be expected to affect special-status grassland species.

- *Avoidance and Minimization Measures*: Effects on Carquinez goldenbush potentially resulting from implementation of CM4 and potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized through AMM2. AMM37 requires that new recreation trails would avoid populations of Carquinez goldenbush. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The primary effect of Alternative 4 on special-status grassland plant species is the loss of potential (i.e., modeled) habitat for Carquinez goldenbush, including part of one occurrence. Adverse effects on the occurrence will be minimized through AMM11. Protecting three unprotected occurrences of Carquinez goldenbush (Objective CGB1.1, associated with CM3) and maintaining and enhancing occupied habitat for Carquinez goldenbush (Objective CGB1.2, associated with CM11) would compensate for any residual effects. One occurrence of Parry's rough tarplant would be affected by CM2, but the effect is not expected to be adverse. No known occurrences of the other special-status grassland species would be affected. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*, would address effects on undiscovered occurrences of special-status grassland species through preconstruction surveys and implementing measures to avoid, minimize, or compensate for impacts to noncovered special-status plant species.

The BDCP would have a potential beneficial effect on special-status grassland plants by protecting 8,000 acres of grassland habitat. To ensure that this habitat preservation would specifically benefit Carquinez goldenbush, the Plan proposes to protect at least three Carquinez goldenbush occurrences in CZs 1 and 11 that are currently not protected and to maintain and enhance occupied Carquinez goldenbush habitat. The preservation of modeled or potential habitat, together with avoidance and minimization of impacts on species occurrences, would reduce any effects of BDCP implementation on covered grassland species to a level that is no longer adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for Carquinez goldenbush would be offset through CM3, CM8, and CM11. Therefore, implementation of Alternative 4 would result in no adverse effects on special-status grassland plant species.

***CEQA Conclusion*:** Because adverse effects on special-status grassland plant species would be avoided or compensated for, Alternative 4 would not result in substantially reducing the numbers or restricting the range of one covered or 11 noncovered special-status grassland species, and this impact would be less than significant. No mitigation is required.

Valley/Foothill Riparian Species

Two covered plants and two noncovered special-status plant species occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-4-65). The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit covered valley/foothill riparian plants (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- Protect and enhance two occurrences of delta button celery. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of delta button celery for a total of two occurrences within the restored floodplain habitat on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. (Objective DBC1.1, associated with CM3 and CM11).
- Protect and enhance two occurrences of slough thistle. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of slough thistle for a total of two occurrences within the 10,000 acres of restored floodplain on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis (Objective ST1.1: associated with CM3 and CM11).

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 4 would affect 869 acres, including 33 acres that are modeled habitat for Delta button-celery and 11 acres that are modeled habitat for slough thistle. Table 12-4-65 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status riparian species in the study area.

Table 12-4-65. Summary of Impacts on Valley/Foothill Riparian Plant Species under Alternative 4

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button-celery modeled habitat	3,361[a]	15	–	–	Habitat loss from floodplain restoration
Slough thistle modeled habitat	1,834	11	–	–	Habitat loss from floodplain restoration
Valley/foothill riparian habitat	17,966	1,133	–	–	Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta button-celery	–	–	1[b]	1	Occurrence potentially affected by floodplain restoration
Slough thistle	–	–	2	2	Occurrences potentially affected by floodplain restoration
Noncovered Species					
Northern California black walnut	–	–	1	0	None
Wright's trichocoronis	–	–	1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland
[b] A second occurrence is in alkali seasonal wetland

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No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plant species are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would be affected by restoration of seasonally inundated floodplain.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the water conveyance facilities would remove 61 acres of valley-foothill riparian habitat under Alternative 4. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian species are within the proposed footprint for the Alternative 4 water conveyance facilities. Therefore, under Alternative 4, construction and operation of the water conveyance facilities would not affect covered or noncovered special-status valley/foothill riparian species.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction and operation of the Yolo Bypass fisheries enhancements would adversely affect 378 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian species are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect the covered or noncovered valley/foothill riparian species.

- *CM3 Natural Communities Protection and Restoration*: Alternative 4 would protect 552 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plant species because no extant occurrences of special-status valley/foothill species are present in the study area.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 552 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian species are within the hypothetical footprint for tidal restoration. Therefore, tidal restoration would not affect the covered or noncovered valley/foothill riparian species.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 78 acres of valley/foothill riparian habitat, including 15 acres of modeled habitat for Delta button-celery along the San Joaquin River in CZ 7. In addition, floodplain restoration would result in more frequent and longer inundation of 18 acres of modeled habitat for Delta button-celery in this area. The area affected contains one historic occurrence of Delta button celery. This occurrence is considered to be extirpated, because all habitat for Delta button-celery at his location has been converted to agriculture (California Department of Fish and Wildlife 2013). Therefore, Alternative 4 would not have an adverse effect on Delta button celery in CZ 7.

  The BDCP proposes to benefit Delta button-celery at this location by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of Delta button-celery. Although Delta button celery occurs in riparian habitat, it is not associated with woodland or scrub habitats; rather, it occurs in alkali seasonal wetlands in floodplains, which may or may not also contain adjacent woody riparian habitat. Restoring habitat for Delta button-celery may not be compatible with restoring woody riparian habitat. In addition, establishing new populations of Delta button-celery is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on Delta button-celery would be speculative.

  Floodplain restoration levee construction would remove 11 acres of modeled habitat for slough thistle and would result in more frequent and longer inundation of 6 acres of modeled habitat for slough thistle along the San Joaquin River in CZ 7. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to riparian habitat. Whether the affected modeled habitat is actually occupied by slough thistle is not known; however, of two historic occurrences of slough thistle present in the study area, only one is considered to be extirpated (California Department of Fish and Wildlife 2013). The BDCP would protect and enhance two occurrences of slough thistle. If occurrences are not found in the study area, then two, self-sustaining occurrences of slough thistle would be established using locally-sourced genetic material for a total of two occurrences within the restored floodplain habitat on the main stem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. Establishing new populations of slough thistle is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on slough thistle would be speculative.

One historic occurrence of Wright's trichocoronis in the study area near Lathrop (CZ 7) could also be affected by floodplain restoration. The occurrence is presumed to be extant because the presence or absence of suitable habitat has not been verified by field surveys (California Department of Fish and Wildlife 2013). However, the species has not been observed at this location for nearly a century, and habitat for Wright's trichocoronis, which would have been similar to that for Delta button celery and slough thistle, no longer appears to be present in aerial photographs of the area. Therefore, Alternative 4 would not be expected to have an adverse effect on Wright's trichocoronis.

- *CM6 Channel Margin Habitat Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered valley/foothill riparian species.
- *CM7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian species are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on covered and noncovered valley/foothill riparian species.
- *CM8 Grassland Natural Community Restoration*: No occurrences of special-status valley/foothill riparian species are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered valley/foothill riparian species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian species are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered valley/foothill riparian species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on covered and noncovered valley/foothill riparian species.
- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of CM5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Because no extant occurrences of special-status valley/foothill riparian plant species are known to occur in the study area, Alternative 4 is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for covered plant species would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 4 would not have an adverse effect on these species.

The BDCP proposes to benefit Delta button-celery and slough thistle by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of both species. Establishing new populations of Delta-button-celery or slough thistle would be a beneficial effect. However, establishing new populations is an untried, unproven procedure and may not be feasible.

NEPA Effects**:** Implementation of the BDCP under Alternative 4 would not have an adverse effect on special-status valley/foothill riparian plant species.

CEQA Conclusion**:** Under Alternative 4, the BDCP would not result in a reduction in the range and numbers of covered and noncovered valley/foothill riparian plant species because no extant occurrences of special-status valley/foothill riparian plant species are known to occur in the study area and because implementation of AMMs would include surveys for covered plant species and measures to avoid or minimize potential impacts through project design. This impact would be less than significant. No mitigation is required.

Tidal Wetland Species

Seven covered plants and one noncovered special-status plant species occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4-66). Five tidal wetland habitat models were developed for the seven covered plant species occurring in tidal wetland habitat.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitats cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 4 would include the following conservation actions over the term of the BDCP to benefit covered tidal wetland species (see Chapter 3, Section 3.3, *Biological Goals and Objectives*, of the BDCP).

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites, or within the area of affected tidal range of restoration projects (Objective DMW/ML1.1, associated with CM4 and CM11).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Objective DTP/SMA1.1, associated with CM4 and CM11).
- Restore tidal inundation to wetlands in the Hill Slough Ecological Reserve and to the ponded area at Rush Ranch (Objective SBB/SuT1.1, associated with CM4).
- Complete seed banking of all existing Suisun Marsh populations and the representative genetic diversity using accepted seed banking protocols (Objective SBB/SuT1.2, associated with CM11).
- Establish a cultivated population of Suisun thistle from wild seed using accepted seed collection protocols (Objective SBB/SuT1.3, associated with CM11).
- Establish two occurrences of Suisun thistle in Conservation Zone 11 (Objective SBB/SuT1.4, associated with CM11).

Of 17,357 acres of tidal wetlands in the study area, Alternative 4 would affect 28 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, Suisun Marsh aster, soft bird's-beak, and Suisun thistle. Known occurrences of all of these species would be affected. In addition, three occurrences of Bolander's water-hemlock, a noncovered special-status species, could be affected by tidal habitat restoration. Table 12-4-66 summarizes the acreage of modeled habitat for covered tidal wetland species and the number of occurrences of each special-status tidal wetland species in the study area.

1 **Table 12-4-66. Summary of Impacts on Tidal Wetland Plant Species under Alternative 4**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/ Mason's lilaeopsis modeled habitat	6,081	62	–	–	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Side-flowering skullcap modeled habitat	2,497	17	–	–	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Soft bird's-beak modeled habitat	1,228	73	–	–	Habitat loss from tidal habitat restoration
Delta tule pea/Suisun Marsh aster modeled habitat	5,853	4	–	–	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Suisun thistle modeled habitat	1,281	73	–	–	Habitat loss from tidal habitat restoration
Tidal brackish emergent wetland	8,501	0	–	–	Habitat loss from tidal habitat restoration
Tidal freshwater emergent wetland	8,856	21	–	–	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta mudwort	–	–	58	3	Occurrences affected by tidal habitat restoration
Delta tule pea	–	–	106	26	Occurrences affected by tidal habitat restoration
Mason's lilaeopsis	–	–	181	23	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Side-flowering skullcap	–	–	12	1	Occurrence affected by construction of water conveyance facilities
Soft bird's-beak	–	–	13	7	Occurrences affected by tidal habitat restoration
Suisun Marsh aster	–	–	164	29	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Suisun thistle	–	–	4	0	None
Noncovered Species					
Bolander's water hemlock	–	–	8	3	Occurrences affected by tidal habitat restoration

2

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 4 would have adverse effects on tidal marsh special-status plant species through implementation of CM1, CM2, CM4, and CM5. No adverse effects are expected from implementation of CM3, or CM6–CM9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 water conveyance facilities would remove 37 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 6 acres of modeled habitat for side-flowering skullcap, and 3 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, eight occurrences of Mason's lilaeopsis, three occurrences of Suisun Marsh aster, and one occurrence of side-flowering skullcap in the study area could be affected by construction impacts. No known occurrences of the other covered and noncovered tidal wetland species would be affected by construction of the water conveyance facilities.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 5 acres of modeled habitat for Mason's lilaeopsis and delta mudwort. The extent to which modeled habitat is actually occupied by these species is not known; however, no known occurrences in the study area would be affected. Yolo Bypass operations would result in more frequent and longer inundation of 8 acres of modeled habitat Delta tule peas and Suisun Marsh aster. Two occurrences of Suisun Marsh aster could be affected by Yolo Bypass operations. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes restoring or creating 20 linear miles of transitional tidal areas within other natural communities that would be created or restored, including 3,000 acres of tidal brackish emergent wetland and 13,900 acres of tidal freshwater emergent wetland. In addition, the habitat and ecosystem functions of these areas would be maintained and enhanced. The BDCP does not specifically propose to protect any occurrences of covered tidal wetland species nor does it propose active restoration of affected habitat or occurrences. Instead, the BDCP assumes that the 20 linear miles of restored transitional tidal areas will be passively colonized by the covered tidal wetland species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 6 acres of modeled habitat for Mason's lilaeopsis and Delta mudwort. Habitat loss would occur through conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 14 of 181 known occurrences of Mason's lilaeopsis and three of 58 known occurrences of delta mudwort in the study area could be affected by tidal habitat restoration.

  Tidal habitat restoration would remove 4 acres of modeled habitat for side-flowering skullcap. Whether the affected modeled habitat is actually occupied by side-flowering skullcap is not known; however, none of the 12 known occurrences in the study area would be affected.

  Tidal habitat restoration would remove 2 acre of modeled habitat for Delta tule pea and Suisun Marsh aster. Habitat loss would result from conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 26 of 112 known occurrences of Delta tule pea and 23 of 145 occurrences of Suisun Marsh aster in the study area could be affected.

Tidal habitat restoration could affect 73 acres of modeled habitat for soft bird's-beak and Suisun thistle, including 1.3 acres of critical habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, seven of 13 known occurrences of soft bird's-beak in the study area could be affected. None of the four known occurrences of Suisun thistle in the study area would be affected.

Tidal habitat restoration could affect three of eight known occurrences of Bolander's water-hemlock, a noncovered special-status species in the study area. Because Bolander's water-hemlock occurs in tidal marsh, it may benefit from tidal marsh restoration. However, site preparation, earthwork, and other site activities could adversely affect Bolander's water-hemlock through direct habitat removal.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 3 acres of modeled habitat for Mason's lilaeopsis and delta mudwort and 2 acres of modeled habitat for side-flowering skullcap. No known occurrences of these species in the study area would be affected by floodplain restoration.

  Floodplain restoration would result in more frequent and longer inundation of 12 acres of modeled habitat for Mason's lilaeopsis and delta mudwort, 6 acres of modeled habitat for side-flowering skullcap, and 1 acre of modeled habitat for Delta tule peas and Suisun Marsh aster. No known occurrences of these species in the study area would be affected by periodic inundation of restored floodplain habitat. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed separately from the effects of tidal habitat restoration. Channel margin enhancement would have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would have beneficial effects on these species by improving the habitat functions for these species as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.

- *CM7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of CM4 and CM5. Riparian plantings carried out for CM7 would be placed in floodplain areas, not in tidal wetlands.

- *CM8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered tidal wetland species.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland species are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered tidal wetland species.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on covered and noncovered tidal wetland species.
- *Avoidance and Minimization Measures*: Effects on covered tidal wetland plant species potentially resulting from implementation of CM1, CM2, CM4, and CM5 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 contains specific guidance to avoid adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis and side-flowering skullcap. AMM37 requires that new recreation trails avoid populations of covered tidal wetland species. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, the GIS analysis indicates that Alternative 4 would result in the loss of modeled habitat for all of the covered species and result in adverse effects on known occurrences of all of the special-status species occurring in tidal wetlands. However, the BDCP predicts that habitat restoration activities would greatly expand the amount of habitat available to each of these species, offsetting any potential loss of habitat or occurrences resulting from covered activities.

Delta mudwort could lose 62 acres of modeled habitat (1.0%), including all or part of three occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta mudwort, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Mason's lilaeopsis could lose 62 acres of modeled habitat (1.0%), including all or part of 23 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Mason's lilaeopsis; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-21, associated with CM11).

Delta tule pea could lose 5 acres of modeled habitat (0.07%), including all or part of 26 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta tule pea, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta tule pea; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

Suisun Marsh aster could lose 5 acres of modeled habitat (0.07%), including all or part of 29 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun Marsh aster, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Suisun marsh aster; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would occur and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11-22, associated with CM11).

All four of these species (Delta mudwort, Mason's lilaeopsis, Delta tule pea, and Suisun Marsh aster) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring large areas of habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected (less than 1% of the total), it is likely that the initial adverse effects of covered activities on these species would be offset and that the overall effect of Alternative 4 on these species would not be adverse.

Side-flowering skullcap could lose 17 acres of modeled habitat (0.68%), including all or part of one occurrence. One occurrence would be avoided through implementation of AMM30. The location of a second potentially affected occurrence, which was last observed in 1892, is not known precisely. Under AMM11, this occurrence would be surveyed for, and because this is a tidal freshwater wetland species, avoidance of the habitat during project construction would be highly likely. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by side-flowering skullcap, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for side-flowering skullcap; creation of suitable habitat under these measures could also help offset this habitat loss. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, and because loss of modeled habitat for the species would be offset through restoration, the overall effect of Alternative 4 on this species would not be adverse.

Soft bird's-beak could lose 73 acres of modeled habitat (6%), including all or part of seven occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by soft bird's-beak, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve would be done to increase potential habitat there for soft bird's-beak (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for soft bird's-beak. Although no active restoration of this species is proposed, post-implementation monitoring of soft bird's-beak occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11–CM22, associated with CM11). Soft bird's-beak has a restricted distribution in the study area with highly localized occurrences, and habitat modification is the primary factor responsible for the species' decline and limiting the species' distribution and abundance. Improving habitat functions for this species would provide a reasonable expectation that the distribution and abundance of soft bird's-beak would also improve. Although a substantial amount of modeled habitat could be affected, the primary habitat for soft bird's-beak is high tidal brackish marsh, and the affected habitat is low tidal brackish marsh. Therefore, it is likely that the overall effect of Alternative 4 on this species would not be adverse.

Suisun thistle could lose 73 acres of modeled habitat (6%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun thistle, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve and at Rush Ranch would be done to increase potential habitat there for Suisun thistle (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for Suisun thistle. In addition, two new occurrences of Suisun thistle would be established in CZ 11 (Objective SBB/SuT1.4, associated with CM11). Post-implementation monitoring of Suisun thistle occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11-22, associated with CM11). Habitat restoration, enhancement of habitat functions, and establishment of new occurrences would offset any potential loss of modeled habitat for Suisun Marsh thistle.

Three occurrences of Bolander's water-hemlock could be affected. Although the extent of potential habitat affected was not determined, it would be comparable to that for Delta tule pea and Suisun Marsh aster (5 acres). Tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) could increase the extent of habitat available for colonization by Bolander's water-hemlock, which could offset this habitat loss. Because only a few scattered occurrences of Bolander's water-hemlock are present in the study area, there is no reasonable expectation that habitat restoration without active species-specific restoration activities would result in the establishment of new occurrences to offset the losses. Also, because Bolander's water-hemlock is a noncovered species, the species protections and occurrence monitoring afforded to covered species under the BDCP would not apply to this species. Therefore, the effects of Alternative 4 on Bolander's water hemlock could be adverse.

NEPA Effects: The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (CM4). Therefore, implementation of Alternative 4 would result in no adverse effects on seven of eight special-status tidal habitat species in the study area. Alternative 4 would result in a reduction in the range and numbers of Bolander's water-hemlock, which would be an adverse effect. Adverse effects on Bolander's water-hemlock could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of occurrences and modeled habitat for covered tidal habitat plant species would be offset through habitat restoration, impacts on covered tidal wetland plants as a result of implementing Alternative 4 would not be significant. However, the loss of Bolander's water-hemlock populations in CZ 11 would result in a reduction in the range and numbers of this species and would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level through preconstruction surveys and implementing measures to avoid, minimize, or compensate for impacts to noncovered special-status plant species.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

Inland Dune Species

Five special-status plant species occur in inland dune habitat in the study area. None of the species is covered under the BDCP, and no habitat models were prepared for inland dune habitat. Table 12-4-67 summarizes the acreage of inland dune habitat in the study area and the number of occurrences for each special-status inland dune species in the study area.

Table 12-4-67. Summary of Impacts on Inland Dune Plants under Alternative 4

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Inland Dunes	19	0	–	–	None
Noncovered Species					
Hoover's cryptantha	–	–	1	0	None
Antioch Dunes buckwheat	–	–	1	0	None
Mt. Diablo buckwheat	–	–	1	0	None
Contra Costa wallflower	–	–	3	0	None
Antioch Dunes evening-primrose	–	–	9	0	None

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 4 would have no adverse effects on inland dune species (Table 12-4-67). No construction activities or habitat restoration would take place where the species occur. No specific actions to benefit inland dune species are proposed.

NEPA Effects: Implementation of the BDCP under Alternative 4 would not affect special-status inland dune species.

CEQA Conclusion**:** Because the BDCP would not affect inland dune habitat, implementation of Alternative 4 would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Species

No covered plant species occur in nontidal wetlands in the study area; however, six noncovered special-status plant species occur in nontidal wetlands in the study area. Table 12-4-68 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland species in the study area.

Table 12-4-68. Summary of Impacts on Nontidal Wetland Plant Species under Alternative 4

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	357	–	–	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, and floodplain restoration
Nontidal freshwater perennial emergent wetland	1,509	140	–	–	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass Fisheries enhancements, and floodplain restoration
Noncovered Species					
Watershield	–	–	3	1	Loss of habitat from construction of water conveyance facilities
Bristly sedge	–	–	18	3	Loss of habitat from construction of water conveyance facilities
Woolly rose-mallow[a]	–	–	121	15	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Eel grass pondweed	–	–	1	0	None
Sanford's arrowhead	–	–	23	2	Loss of habitat from construction of water conveyance facilities and tidal habitat restoration
Marsh skullcap[a]	–	–	1	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 4, known occurrences watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead would be within the proposed footprint for the water conveyance facilities or within the hypothetical footprint for restoration activities and would be adversely affected. Alternative 4 would have no adverse effects on eel-grass pondweed or marsh skullcap.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 4 water conveyance facilities would adversely affect four noncovered special-status plant species occurring in nontidal wetlands. One of three watershield occurrences in CZ 5 on Bouldin Island could be affected by construction of the water conveyance facilities. This is a historical occurrence that has not been observed since 1893, and it may be extirpated (California Department of Fish and Wildlife 2013). Three occurrences of bristly sedge in CZ 4 and CZ 5, including approximately 1.54 acres of occupied habitat, would be affected by construction of the water conveyance facilities. Fifteen occurrences of woolly rose-mallow would be affected. Six occurrences in CZ 4 could be removed during construction of the intake facilities and disposal of reusable tunnel material, and four occurrences in CZ 6 and four occurrences in CZ 8 would be affected by construction of other facilities and by geotechnical investigations. Construction of the water conveyance facilities would remove occupied habitat at one occurrence of Sanford's arrowhead in CZ 4. Under Alternative 4, construction and operation of the water conveyance facilities could affect 77 acres of nontidal wetlands, which could have adverse effects on undiscovered occurrences of the six non-covered special-status nontidal wetland plant species.
- *CM2 Yolo Bypass Fisheries Enhancement*: No known occurrences of special-status nontidal wetland plants are present in the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect special-status nontidal marsh species.
- *CM3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under the BDCP. Therefore, no occurrences of special-status nontidal species are proposed for protection.
- *CM4 Tidal Natural Communities Restoration*: One known occurrence of Sanford's arrowhead is present within areas that could be affected by tidal habitat restoration in CZ 2. One known occurrence of woolly rose-mallow is present within areas that could be affected by tidal habitat restoration in CZ 7. No other known occurrences of special-status nontidal wetland species are present within areas proposed for tidal habitat restoration. Therefore, tidal habitat restoration could have adverse effects on two special-status nontidal wetland species.
- *CM5 Seasonally Inundated Floodplain Restoration*: No known occurrences of special-status nontidal wetland species are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on special-status nontidal wetland species.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on known occurrences of special-status nontidal wetland species.

- *CM7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland species are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on known occurrences of special-status nontidal wetland species.
- *CM8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland species are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland species are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status nontidal wetland species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland species. The BDCP may benefit nontidal wetland species by creating 400 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for covered and other native species. However, no specific actions to benefit noncovered species are proposed.

Under Alternative 4, 1,500 acres of nontidal marsh would be restored (Objective NFEW/NPANC1.1, addressed under CM10). However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, potential loss of habitat or occurrences resulting from covered activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under the BDCP, the species protections afforded to covered species under the AMMs do not apply to these species, and the effects of Alternative 4 on these species would be adverse. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*, would reduce these effects.

NEPA Effects: Implementation of the BDCP under Alternative 4 could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, four noncovered nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Under Alternative 4, construction of the water conveyance facilities could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead. Tidal habitat restoration could result in a reduction in the range and numbers of woolly rose-mallow and Sanford's arrowhead. These impacts would be significant. Implementation of Mitigation Measure BIO-170, which requires avoidance, minimization and compensation actions for impacts to noncovered species, would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

General Terrestrial Biology

Wetlands and Other Waters of the United States

Alternative 4 actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The Section 404 regulations and relevant information regarding mitigation of impacts on wetlands and waters of the United States are described in Section 12.2.1.1. The following two impacts address the project-level effects of CM1 on these potential wetlands and waters, and the programmatic-level effects of other relevant conservation actions (CM2–CM10). CM11–CM21 would not directly result in loss or conversion of wetlands or other waters of the U.S. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. The waters of the United States data used for this analysis is based on a verified wetland delineation from USACE that was completed in early 2015. These waters of the United States were mapped at finer scale than that which was done for the natural community mapping for the BDCP; therefore, the acreages of these two datasets differ. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States

Alternative 4 proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-4-69. Based on the methodology used to conduct this analysis, the losses would occur at intake, tunnel, pipeline, canal, and RTM and borrow/spoil storage sites, transmission corridors, and multiple temporary work areas associated with the construction activity. The permanent wetland or other waters of the United States loss would occur at various locations along the modified pipeline/tunnel alignment. The majority of the loss would occur due to the expansion of Clifton Court Forebay, new transmission lines, construction of Alternative 4's three intake structures along the eastern bank of the Sacramento River between Clarksburg and Courtland in the north Delta, and at the RTM storage sites associated with tunnel construction at various locations, including sites between Lambert Road and Twin Cities Road, on Bouldin Island, and on Byron Tract, adjacent to Clifton Court Forebay. Through implementation of an environmental commitment to reuse RTM or dispose of it at appropriate facilities, as described in Appendix 3B, *Environmental Commitments, AMMs and CMs*, it is anticipated that the material would be removed from these areas and applied, as appropriate, as bulking material for levee maintenance or as fill material for habitat restoration projects, or would be put to other beneficial means of reuse identified for the material.

The temporary effects on wetlands and waters of the United States would also occur mainly at the three intake construction sites along the eastern bank of the Sacramento River, and at barge unloading facilities in the San Joaquin River, Snodgrass Slough, Potato Slough, Connection Slough, Old River, and West Canal. An additional temporary effect would result from dredging of Clifton Court Forebay.

Table 12-4-69. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 4 (acres)

Habitat Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]
Agricultural Ditch	42.2	13.2	0	55.4
Alkaline Wetland	10.4	0.1	0	10.5
Clifton Court Forebay	257.9	0	1,930.6	257.9
Conveyance Channel	7.1	2.9	0	10.0
Depression	29.3	6.2	0	35.5
Emergent Wetland	56.8	14.7	0	71.5
Forest	7.2	5.2	0	12.4
Lake	23.2	0	0	23.2
Scrub-Shrub	12.7	3.7	0	16.3
Seasonal Wetland	114.5	10.0	0	124.5
Tidal Channel	15.3	65.6	0	80.8
Vernal Pool	0.3	0	0	0.3
Total	**577**	**121**	**1,931**	**698**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

[b] Temporary impacts are due to dredging Clifton Court Forebay

[c] Total does not include temporary impacts to Clifton Court Forebay because these would just be temporary disturbance to open water, which typically do not require compensatory mitigation.

The majority of the impacts on wetlands and waters of U.S. are to wetlands found within cultivated lands (mostly agricultural ditches and seasonal wetlands) and waters associated with Clifton Court Forebay. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields and would be mostly affected by the RTM storage sites and transmission line construction. The effects on Clifton Court Forebay would primarily result from the establishment of new embankments around and across the existing forebay. The forebay would be expanded to the south by an additional 450 acres of storage space resulting in a net gain of open water in the forebay.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the Clean Water Act permitting process. The results of this assessment will be compared with the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands would be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Because many impacted wetlands are significantly less than high function, the compensatory mitigation would result in a net increase in wetland function.

Alternative 4 was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures will be implemented, as described in the AMMs set out in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the U.S. are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, would also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing CM4–CM10, some of which could serve the dual purpose of offsetting effects to species and mitigating impacts on waters of the U.S., more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 4 pursuant to USACE's and EPA's Mitigation Rule (see Section 12.2.1.1). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to address adverse impacts on waters of the United States.

NEPA Effects: The permanent and temporary loss of these jurisdictional wetlands and waters of the United States as a result of constructing Alternative 4 water conveyance facilities would be a substantial effect if not compensated by wetland protection and/or restoration. This loss would represent a removal of federally protected wetlands as defined by Section 404 of the CWA. Project proponents under Alternative 4 would implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects on wetlands and waters. However, specific mitigation would be required to ensure that Alternative 4 does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

CEQA Conclusion: The permanent and temporary loss of these jurisdictional wetlands and waters of the United States as a result of constructing Alternative 4 water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 4 does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level. Alternative 4 does propose to restore up to 76,721 acres of wetland natural communities under the Plan, which would include 65,000 acres of tidal marsh restoration (CM4), 10,000 acres of seasonally inundated floodplain restoration (CM5), 21 acres of vernal pool/alkali seasonal wetlands (CM9; 67 acres of vernal pool complex and 72 acres of alkali seasonal wetland complex assuming a wetland density of 15%), and 1,700 acres of nontidal marsh restoration (CM10). In addition, Alternative 4 would restore 5,000 acres of riparian habitat (CM7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 20 miles of levees will have channel margin enhancement conducted on them (CM6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees.

The success in implementing these conservation measures would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP for tidal marsh restoration (BDCP Section 3.4.4.4), seasonal floodplain restoration (BDCP Section 3.4.5.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 4 would also result in the protection and management of the following natural communities that contain wetlands: 750 acres of valley/foothill riparian, 600 acres of vernal pool complex, 150 acres of alkali seasonal wetland complex, 8,100 acres of managed wetlands, and 50 acres of nontidal marsh. In addition, 8,000 acres of grasslands and 51,625 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Project proponents under Alternative 4 would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of waters of the United States and any indirect effects on wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 4 does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;

- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 4's other conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and waters of the United States in the study area over the course of BDCP conservation action implementation. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures

(CM2, CM4, and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in BDCP Chapter 5, *Effects Analysis*,

Because the wetland delineation was only conducted within the Conveyance Planning Area and not the remainder of the Plan Area, the effects on potential wetlands and waters of the United States from CM2-CM10 were analyzed by looking at effects on wetland natural communities mapped within the theoretical footprints for CM2, CM4, and CM5 by assuming that 100% of the predominantly wetland natural communities listed in Table 12E-37 of Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities*, and that 10% of all of the non-wetland natural communities listed in that table would qualify as wetlands or other waters of the United States under the CWA. Based on this approach, approximately 19,850 acres of potentially jurisdictional wetlands and waters could be affected by CM2-CM10. The majority of these impacts are attributable to the conversion of 13,746 acres of managed wetland to tidal marsh under CM4, which would likely result in an improvement of wetland function in the Plan Area.

NEPA Effects: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 4 would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. Although the increase in wetland acreage and wetland functions from these restoration actions could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

CEQA Conclusion: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 4 would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. In total, up to 76,721 acres of wetland natural communities would be restored under Alternative 4. Although the increase in wetland acreage and wetland functions from this restoration could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds. The primary effects of concern for shorebirds and waterfowl are related to the conversion of managed wetland and cultivated lands to tidal marsh associated with habitat restoration. Ducks Unlimited (2013) conducted an analysis to determine the effects of BDCP conservation measures on waterfowl, as well as to determine whether BDCP actions would impede attainment of the goals established by the Central Valley Joint Venture (CVJV) Implementation Plan for the Delta, Yolo, and Suisun Marsh drainage basins. The CVJV efforts are guided by its 2006 Implementation Plan, which is founded on the principles of strategic habitat conservation (Central Valley Joint Venture 2006). Those principles emphasize the establishment of population abundance objectives and the use of species-habitat models to link population objectives to habitat needs. The CVJV has used species-habitat models to translate bird abundance objectives into habitat objectives, while explicitly identifying the biological assumptions that underpin these models and the data used to populate them. As a result, the CVJV's biological planning provides a framework for evaluating the effects of the BDCP on waterfowl.

The Ducks Unlimited waterfowl analysis focused primarily on dabbling ducks. Less than 5% of all geese in the Central Valley occur in the Yolo, Delta, and Suisun Marsh drainage basins. Moreover, geese in the Central Valley rely mostly on agricultural habitats to meet their food energy needs. The BDCP's effect on agricultural habitats is limited to the Delta Basin where about 2500 acres of corn now available to geese would be converted to other habitats (Ducks Unlimited 2013: Table 5). Food supplies for geese would still be well in excess of demand even with the loss of these agricultural habitats (Central Valley Joint Venture 2006, Ducks Unlimited 2013). The duck population objectives used in the analysis were taken directly from the CVJV Plan. Dabbling duck species make up 92% of this objective, while diving duck species make up the remaining 8%. Thus, the results were mostly driven by dabbling duck needs and largely interpreted in the context of dabbling duck foraging ecology. The 55,000 acres of Tidal Natural Communities Restoration (CM4) would be expected to benefit diving ducks by providing deep water foraging habitat. Refer to the Ducks Unlimited Report (Ducks Unlimited 2013) for details of the analysis and methods with respect to the TRUMET model used to quantify effects on food biomass and food quality.

An analysis was conducted to determine the effects of the BDCP covered activities on wintering and breeding shorebird habitat (ICF International 2013). This analysis evaluated the relative increase and decrease in natural communities known to provide important foraging, roosting, and breeding habitat. Similar to the waterfowl analysis, the results were broken up into the three Central Valley Joint Venture Basins that overlap with the BDCP study area: Yolo, Delta, and Suisun. Natural community losses and gains were then translated into species-specific outcomes, comparing the relative habitat value of each BDCP natural community for each Central Valley shorebird species (Table 1, ICF International 2013). The shorebird species ranking system displayed in Table 1 (ICF International 2013) was modified from a table in Stralberg et al. (2011). The table was created using survey data and experts' species-specific habitat rankings. The survey data included fall, winter, and spring density data. This resulted in an overall, cross-season representation of habitat requirements.

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities (CM1) would result in the permanent removal of approximately 22 acres of managed wetland, 3 acres of tidal wetlands, 61 acres of nontidal wetlands, and 3,768 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 29 acres of managed wetland, 15 acres of tidal wetlands, 15 acres of nontidal wetlands, and 1,339 acres of suitable cultivated lands would be temporarily impacted. No rice would be impacted as a result of constructing the water conveyance facilities. These losses of habitat would occur within the first 10 years of Alternative 4 implementation in the Delta Basin. The BDCP has committed to the near-term protection of 15,400 acres of non-rice cultivated lands, 200 acres of rice, and 700 acres of rice or "rice equivalent" natural communities including nontidal wetlands in the near-term. In addition, 4,100 acres of managed wetlands would be created, protected, and enhanced, 8,850 acres of freshwater tidal wetlands would be restored, and 2,000 acres of tidal brackish emergent wetland would be restored (see Table 3-4 in Chapter 3, *Description of Alternatives*).

Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***NEPA Effects*:** Habitat loss from construction of the Alternative 4 water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would represent an adverse affect on nesting shorebirds and waterfowl individuals. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***CEQA Conclusion*:** In the absence of other conservation actions, habitat loss from construction of the Alternative 4 water conveyance facilities could represent an adverse effect on shorebirds and waterfowl through habitat modification. However, with of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe, this impact would be less-than significant. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, which would require indentification of nesting birds prior to disturbance and would allow for avoidance measures, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Conservation Components

Suisun Marsh: Managed seasonal wetlands in Suisun Marsh would be reduced by an estimated 8,818 acres as a result of implementing Alternative 4. This would represent a 25% decrease in managed seasonal wetlands compared with long-term conditions without Alternative 4 (Ducks Unlimited 2013, Table 5; ICF International 2013). There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the amount of mitigation needed. To address this uncertainty, three levels of food biomass and three levels of nutritional quality were modeled for these existing habitats (Ducks Unlimited 2013, Table 7). Three mitigation scenarios were based on these energetic assumptions of biomass and food quality were then run to determine a minimum acreage of managed seasonal wetlands to be protected and enhanced to compensate for the loss of productivity from habitat conversion to tidal wetlands.

- Scenario 1) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 50% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 60% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun Marsh could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 5,000 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

- Scenario 2) Assume that the managed seasonal wetlands lost provide medium food biomass and medium food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun Marsh could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 13,300 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 3) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Given the assumption that managed seasonal wetlands in Suisun Marsh could only be enhanced to provide medium food biomass and medium food quality (produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun Marsh), 8,800 acres of managed wetlands protected and managed for medium biomass and medium food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

The BDCP has committed to protecting and enhancing a minimum of 5,000 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity from habitat conversion to tidal marsh. This minimum commitment of 5,000 acres would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

Yolo and Delta Basins: The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta Watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo Watershed would not be expected to have an adverse effect on food productivity, under the assumption that these wetlands would provide adequate food sources. However, a monitoring component and a food study in these tidal habitats would be necessary order to demonstrate that there is a less-than-significant loss of food value in these habitats for wintering waterfowl. If it is determined from monitoring, that there is in fact a significant loss in food productivity from habitat conversion to tidal wetlands, the protection and enhancement of managed wetlands in these watersheds would be required to mitigate the change in food biomass and quality. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty.

***NEPA Effects*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of effect that Alternative 4 habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun

Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of these 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 4 to avoid an adverse effect on wintering waterfowl in the Suisun Marsh. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these new wetlands would provide adequate food sources is entirely dependent on assumptions about food production in palustrine tidal habitats. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty and avoid an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of impact that Alternative 4 habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of these 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food for wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 4 to avoid having a significant impact on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Implementation of Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would address this potential significant impact.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity. However, the conclusion that these tidal wetlands would provide adequate food sources for wintering waterfowl is entirely dependent on assumptions about food production in palustrine tidal habitats. Studies of food biomass and food quality in palustrine tidal habitats are needed to confirm that no mitigation for wintering waterfowl would be required in the Yolo and Delta Basins. Implementation of Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would address this uncertainty and would reduce the impact of loss or conversion of habitat for wintering waterfowl to a less-than-significant level.

Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh

Poorly managed wetlands (considered low biomass and food quality) will be identified and managed by BDCP proponents to improve food quality and biomass. Studies will be required to quantify 1) food production of existing managed wetlands in Suisun Marsh and 2) energetic productivity of brackish and tidal marsh habitats. Protected wetlands will be monitored to measure changes in the energetic productivity of these sites. Based on the food studies and monitoring results, BDCP proponents will determine if the minimum commitment of 5,000 acres is sufficient to meet the goal of 1:1 compensation for loss of wintering waterfowl habitat with the protection and management of managed wetlands in perpetuity. If monitoring demonstrates that additional acreage is needed to meet this goal, additional acreage of protection or creation of managed wetlands and management will be required.

Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins

In order to address the uncertainty of the impact of loss of managed wetlands in the Yolo and Delta Basins on wintering waterfowl, BDCP proponents will conduct food studies and monitoring to demonstrate the food quality of palustrine tidal habitats in these basins. If studies show that the assumption of no effect was inaccurate, and the food quality goal of 1:1 compensation for wintering waterfowl food value is not met, additional acreage of protection or creation of managed wetland and management will be required.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Conservation Components

Yolo and Delta Basins: Implementation of Alternative 4 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 4 would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. While a reduction in these semipermanent habitats would represent a habitat loss for breeding waterfowl, with the restoration of 24,000 acres of palustrine tidal wetlands (see Table 3-4 in Chapter 3, *Description of Alternatives*) in the Yolo and Delta basins there would be a less than adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (i.e., March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 4.

Suisun Marsh: Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres from the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared to seasonally managed habitats (Central Valley Joint Venture 2006).

The BDCP includes a commitment to protect and enhance 1,600 acres of permanently flooded managed wetlands in Suisun Marsh to provide habitat for breeding waterfowl. In addition, 5,000 acres of semipermanent wetlands that would be protected and enhanced for wintering and migratory waterfowl (see Table 3-4 in Chapter 3, *Description of Alternatives*, of the EIR/EIS; Objective MWNC1.1 in BDCP Chapter 3, *Conservation Strategy*).

Food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. These studies would be needed in order to quantify impacts to breeding waterfowl in Suisun Marsh and to determine not only the number of acres that would compensate for loss of breeding habitat at a ratio of 1:1 for habitat value, but how those acres should be managed. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of this effect.

In addition to providing semipermanent wetlands to breeding waterfowl, the Suisun Marsh contains several key upland areas that have significant nesting value. The largest block of upland habitat in the region is the core area on the Grizzly Island Wildlife Area. This area does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this core area includes over 2,000 acres of upland grasslands that have some of the highest duck nesting densities in California (Central Valley Joint Venture 2006). A few small wetland areas are scattered within this core grassland mosaic that provide necessary freshwater brooding habitat. If restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding waterfowl would likely be greatly increased.

NEPA Effects: Implementation of Alternative 4 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 4 would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 4 would not have an adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 4 implementation. Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but such management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss of breeding waterfowl habitat resulting from implementation of Alternative 4 could have an adverse effect. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of model assumptions and the potential adverse effect of habitat conversion on breeding waterfowl in Suisun Marsh.

CEQA Conclusion: Implementation of Alternative 4 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 4 would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 4 would have a less-than-significant impact on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 4.

Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss or conversion of habitat from implementation of Alternative 4 could have a significant impact on breeding waterfowl in Suisun Marsh. Implementation of Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would address the uncertainty of model assumptions and reduce the impact to a less-than-significant level.

Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

To address the uncertainty of the impact of loss of managed wetlands in Suisun Marsh on breeding waterfowl, BDCP proponents will conduct food studies and monitoring to determine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the marsh.

The required studies will examine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the Marsh. Reproductive studies will address but will not be limited to the following questions:

- How does the distribution of breeding waterfowl in Suisun Marsh differ in tidal versus managed habitats and across salinity gradients?
- How does waterfowl nest success and nest density vary with respect to tidal versus managed habitats and across salinity gradients?
- What are the patterns of habitat selection and movements by waterfowl broods in relation to tidal vs. managed habitats, and are there impacts on duckling survival?
- What is the current relationship between waterfowl reproductive success and interactions with alternate prey and predators, and how is tidal restoration likely to alter these relationships?

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20 cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

Yolo Basin: Primarily as a result of *CM4 Tidal Natural Communities Restoration* within the Yolo Basin, 1,185 acres of managed wetland habitat would be permanently converted; 1,066 acres of which are protected. In addition, 42 acres of managed wetland habitat would be temporarily lost by construction-related activities associated with tidal restoration (CM4) and Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could periodically affect managed wetlands ranging from an estimated 643 acres during a notch flow of 1,000 cfs to an estimated 2,055 acres during a notch flow of 4,000 cfs in the Yolo Basin (see Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*).

Delta Basin: Within the Delta Basin, 90 acres of managed wetland habitat would be permanently converted, as a result of tidal restoration (CM4). Thirteen of the 90 acres are protected (Table 3, ICF International 2013). Periodic flooding would not affect this natural community type in Delta Basin.

Suisun Basin: Within the Suisun Basin, 11,532 acres of managed wetland habitat would be permanently converted as a result of tidal restoration (CM4); 10,354 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (*Charadrius semipalmatus*), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

Managed wetlands would decrease in overall extent by 20% (Table 5, ICF International 2013). Most of this loss would occur in Suisun with some additional acreage loss in the Yolo Basin. The loss of managed wetland habitat for covered species and waterfowl would be compensated for with 8,200 acres remaining managed wetland protection in Suisun Marsh. Of these 8,200 acres, the 5,000 acres of seasonal wetland protected, enhanced, and managed to provide overwintering waterfowl foraging habitat would be the habitat type most likely to benefit overwintering shorebirds. However, the 1,600 acres of semi-permanent and permanent managed wetlands for breeding waterfowl and 1,500 acres of managed wetlands for salt marsh harvest mouse would also be expected to have some benefit to wintering and breeding shorebirds.

Cultivated Lands

Yolo Basin: Primarily as a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 8,309 acres of cultivated lands would be permanently converted; 1,272 acres of which are protected. Also within the Yolo Basin, increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could affect an estimated 3,219 acres of cultivated lands during a notch flow of 1,000 cfs to an estimated 5,512 acres during a notch flow of 6,000 cfs (see Table 5.4-2 in BDCP Chapter 5, *Effects Analysis*).

Delta Basin: Within the Delta Basin, as a result of tidal restoration (CM4) and floodplain restoration (CM5), 25,633 acres of cultivated lands would be permanently converted. There would also be an additional 112 acres lost temporarily due to CM5 activities. Of the total permanently converted lands, 3,925 acres are protected (Table 3, ICF International 2013). Seasonal flooding (CM5) on the restored floodplain would periodically affect 738 acres of cultivated lands in Delta.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Cultivated land loss would occur in all three basins, but the majority of acreage loss would occur in the Delta basin. Pasture crop types would decrease in overall extent by 15% over baseline (Table 5, ICF International 2013), but would increase in protection by 135%. More than half of all cultivated lands within the 48,000-acre BDCP cultivated lands reserve would be in pasture production (primarily alfalfa) and enhanced and managed to benefit Swainson's hawk. Idle crop types are not identified as a specific conservation target in the BDCP, are expected to occur within the reserve and are recognized in the BDCP as having "moderate" foraging habitat value for Swainson's hawk, white-tailed kite, and greater sandhill crane.

Grain and hay crop would be expected to decrease by 13% (Table 5, ICF International 2013) while protection, enhancement and management would be expected to increase by 28% (Table 6, ICF International 2013). These crop types would be managed for a tricolored blackbirds, Swainson's hawk, white-tailed kite, greater sandhill crane, and burrowing owls.

Rice would decrease in overall extent by 2% (Table 5, ICF International 2013) but increase in total protection by 57%. Rice lands would be protected, enhanced, and managed for the benefit for giant garter snake.

Tidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 194 acres of tidal wetland habitat would be permanently converted; 180 acres of which are protected. In addition, 12 acres of tidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass would affect 3,957 acres of tidal wetlands in Yolo Basin.

Delta Basin: Within the Delta Basin, 54 acres of tidal wetlands would be permanently converted as a result of tidal restoration (CM4) (Table 3, ICF International 2013). Of the total permanently converted lands, 26 acres are protected. Periodic flooding in Yolo Bypass would affect 26 acres of tidal wetlands in Delta Basin.

Suisun Basin: Within the Suisun Basin, 219 acres of tidal wetland habitat would be permanently converted as a result of tidal restoration (CM4); 215 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

Tidal mudflat habitat would be estimated to increase in extent by 1,780 acres. This extremely large increase in tidal mudflat habitat would occur almost exclusively in Suisun Marsh as the result of tidal restoration and the conversion of existing mid- and high-marsh types to low marsh and tidal mudflats in response to sea level rise. BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, details the methods and assumptions modeled to come about this result. Tidal mudflat habitats would be expected to require management, however, sediment augmentation has been discussed as an experimental method that could be employed in places like Suisun to combat the loss of intertidal marshes in the face of sea level rise and reduced sediment supplies.

Tidal emergent wetland habitat would increase in extent by 152% (Table 5, ICF International 2013). Of the 30,000 acres of emergent wetland restoration, 6,000 acres would be in the Suisun Basin and the rest would be distributed between the Yolo and Delta Basins. Enhancement and management on these lands would be likely to be focused on nonnative, invasive species management. Any additional actions in Suisun would be focused on salt marsh harvest mouse, Suisun shrew, California clapper rail, black rail, Suisun thistle, and soft bird's-beak. In freshwater marshes, enhancement and management would be likely to focus on black rail, western pond turtle, and, in some cases, giant garter snake.

Nontidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and fisheries enhancement activities (CM2) within the Yolo Basin, 313 acres of nontidal wetland habitat would be permanently converted; 119 acres of which are protected. In addition, 11 acres of nontidal wetland habitat would be temporarily lost by construction-related activities associated with fisheries enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass associated with ongoing Fremont Weir operation (CM2) would affect 305 acres of nontidal wetlands in Yolo Basin, specifically nontidal perennial aquatic habitat.

Delta Basin: Within the Delta Basin, 99 acres of nontidal wetlands would be permanently converted as a result of tidal restoration (CM4) and floodplain restoration (CM5) (Table 3, ICF International 2013). There would also be 8 acres of nontidal perennial aquatic habitat temporarily lost from CM5 activities. Of the total permanently converted lands, 29 acres are protected. Periodic flooding from CM5 would affect 4 acres of nontidal perennial aquatic habitat in Delta Basin.

Suisun Basin: Within the Suisun Basin, 1 acre of nontidal wetland habitat, specifically vernal pool complex, would be permanently converted as a result of tidal restoration (CM4); and is not protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

Nontidal freshwater emergent wetland would increase in extent by 88% as a result of BDCP implementation (Table 5, ICF International 2013). These lands would be managed to benefit giant garter snake and located within the Delta Basin (likely in the vicinity of White Slough) and the Yolo Basin (in the Cache Slough area).

Impacts on wetted acres of vernal pool complex and alkali seasonal wetland complex would be avoided and thus loss of this community is not expected. However, up to 10 acres of wetted acre loss could be permitted under the Plan. Protection of vernal pool complex natural community would increase by 13% and by 6% for alkali seasonal wetlands (Table 6, ICF International 2013). Protection of these two community types would enhance and manage habitat for vernal pool crustaceans and alkali-related plant species.

The protection and restoration of natural communities would also include management and enhancement actions under *CM11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under CM11 in areas where they would not conflict with covered species management.

- Managed wetlands:
  - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
  - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
  - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
  - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
  - Create low slopes on islands and levees; gradual angles (10-12:1) are better than steep angles.

- Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
- Potentially add material to levees or to islands to encourage nesting for some species.

- Cultivated Lands:
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July–September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
  - Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).
  - Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
  - Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
  - When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
  - Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
  - Maintain gently sloping levees and island sides (10-12:1; Iglecia et al. 2012).
  - Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

NEPA Effects: Alternative 4 implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be substantial loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While substantial losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for the loss of substantial acreage, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

***CEQA Conclusion*:** Alternative 4 implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be significant loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While significant losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for substantial acreage loss, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other conservation actions. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight diverters on new transmission lines and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes which could have a substantial adverse effect as a result of direct mortality. This impact would be significant. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of power line strikes from the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in shorebird and waterfowl species. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification. Shorebirds and waterfowl that forage on invertebrates and bivalves, may therefore have lower concentrations of methylmercury than diving ducks that forage on fish. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that shorebird and waterfowl mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas (CM4 and CM5) could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects**:** Noise and visual disturbances from the construction of Alternative 4 water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 4 implementation would not have an adverse effect on shorebirds and waterfowl.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on shorebirds and waterfowl.

CEQA Conclusion: Indirect effects that include noise and visual disturbance, potential hazardous spills, increased dust and sedimentation, and increased methylmercury and selenium exposure as a result of Alternative 4 water conveyance facilities construction and operation and maintenance would represent an adverse effect as a result of habitat modification and potential for direct mortality of shorebirds and waterfowl in the absence of other conservation actions. This would be a significant impact.

AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce potential adverse effects of noise, visual disturbance and potential for spills, dust, and sedimentation.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in a less-than-significant impact on shorebirds and waterfowl.

Therefore, with AMM1-7, AMM27, and CM 12 in place, in addition to the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4 implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4 implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not all covered under laws or regulations that address conservation or protection of individual species. Common wildlife do have some level of protection under California Fish and Game Code and most bird species have protections under the Migratory Bird Treat Act. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed the analysis of Alternative 4 effects on natural communities (Impacts BIO-1 through BIO-31). In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the Plan over a 50-year time period, several natural communities and land cover types would be reduced in size, primarily from restoration of other natural communities. Grassland, managed wetland and cultivated lands would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement, and management actions contained in the BDCP, including *CM3 Natural Communities Protection and Restoration*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing BDCP conservation measures would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife, including increased traffic on local roads from construction vehicles that could increase wildlife mortality and impede wildlife movement. Effects of construction traffic on wildlife moving in the vicinity of Stone Lakes NWR would be minimized by *AMM20 Greater Sandhill Crane*, which includes a measure for the installation of a vegetation screen or other noise and visual barrier along Hood Franklin Road for the benefit of cranes, which would be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and would provide a continuous surface impenetrable by light. This measure would potentially direct wildlife wishing to cross Hood Franklin toward the overcrossing of the canal that links the Stone Lakes properties, just east of the town of Hood. The overcrossing includes strips of terrestrial habitat on either side of the canal.

Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants).

NEPA Effects: The direct and indirect effects associated with implementing the conservation measures of Alternative 4 would not be adverse because the conservation measures and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

CEQA Conclusion: Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of the BDCP is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

Essential Connectivity Areas (ECAs) are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effect of BDCP Conservation Measures on Wildlife Corridors

Alternative 4 water conveyance facilities would cross two of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA and the Mandeville Island-Staten Island ECA. The conveyance facilities would also cross two landscape linkages identified in the BDCP, the *Middle River* linkage (#6 in Figure 12-2) and the *Cosumnes to Stone Lakes* linkage (#10 in Figure 12-2). Though the conveyance facilities shown on Figure 12-2 overlap with the line representing the *Sacramento River* linkage (#9 in Figure 12-2) this line generally represents the course of the Sacramento River and is intended to address the needs of aquatic species and will thus not be addressed in this chapter.

The construction of Intakes 2 and 3, temporary tunnel work areas, and RTM areas j would occur within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the Sacramento River and the permanent and temporary loss of cultivated lands. Alternative 4 would not substantially increase impediments to movement of any nonavian wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento River Deep Water Ship Channel already create a barrier to dispersal for nonavian species. However, the conversion of riparian and cultivated lands and the presence of the intakes would locally constrict the north-south movement of nonavian terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River. No records of wildlife species were identified within these construction footprints, though there are several records for Swainson's hawk in the vicinity. Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The addition of temporary transmission lines within the Stone Lake-Yolo Bypass ECA and across the *Cosumnes to Stone Lakes* linkage, which would be in place for approximately 7 years, could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes and by the east-west transmission line between Stone Lakes and the Cosumnes Preserve; however this line would generally parallel an existing transmission line. The *Cosumnes to Stone Lakes* linkage was developed by BDCP for reserve planning to benefit greater sandhill crane movement from north to south in the Plan Area. Because the proposed east-west transmission line parallels an existing line and would only be in place for approximately 7 years it would not likely create a barrier to the future movement of cranes in this area (see impact discussions for greater and lesser sandhill cranes).

The Alternative 4 conveyance facilities would also pass through the Mandeville Island-Staten Island ECA, which also has several know roost locations for greater sandhill crane. Within this ECA, Alternative 4 would result in the construction of a large RTM disposal area on Bouldin Island, permanent access roads on Bouldin and Mandeville Islands, and temporary transmission lines across most of the ECA. As discussed above, the temporary transmission lines could adversely affect the movement of cranes and other bird species during periods of low visibility. The RTM disposal area may create a physical barrier to movement for some species and could make this area unusable as wildlife habitat for close to 10 years during the tunnel construction. The access roads are mostly located on existing dirt and paved roads and would therefore not create any new physical barriers but could temporarily increase road mortality during periods of construction. The conveyance alignment at this location would be within the tunnel and thus not create a barrier to wildlife movement.

Alternative 4 temporary transmission lines would cross the *Middle River* linkage on Woodward Island. This linkage was established to guide riparian restoration along the Middle River to improve riparian connectivity for the benefit of riparian brush rabbit, riparian woodrat, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Swainson's hawk, and white-tailed kite. Because this transmission line is temporary it would only temporarily conflict with the future planning for and the current movement of the avian species that use riparian corridors.

Alternative 4 conveyance facilities would create some localized disruption in wildlife movement and the temporary and permanent transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 4 alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts (the intakes) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel).

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

NEPA Effects: Alternative 4 conveyance facilities would create local barriers to dispersal but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4 would not adversely affect wildlife corridors.

CEQA Conclusion: Alternative 4 conveyance facilities would create some localized disruption in wildlife movement and the permanent and temporary transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 4 alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts, (the intakes) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel).

Restoration activities would occur in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Community Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the Plan Area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

Alternative 4 conveyance facilities would create local barriers to dispersal and create barriers to safe movement of avian species during periods of low visibility but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4 would result in less-than-significant impacts on wildlife corridors.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities covered under the BDCP could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of the BDCP are listed here.

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.
- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from four activities.

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, reusable tunnel material, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-4-70 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 4.

Table 12-4-70. Summary of Temporary Disturbance in Natural Communities under Alternative 4

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	2,114
Tidal brackish emergent wetland	0
Tidal freshwater emergent wetland	16
Valley foothill riparian	154
Grassland	424
Inland dune scrub	0
Alkali seasonal wetland complex	0
Vernal pool complex	3
Other natural seasonal wetland	0
Nontidal freshwater perennial emergent wetland	7
Nontidal perennial aquatic	38
Managed wetlands	73
Cultivated lands	2,896
Total	**5,649**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Under Alternative 4, the BDCP would have adverse effects on natural communities as a result of the introduction and spread of invasive plant species through implementation of CM1–CM10 and AMM6. No adverse effects are expected from implementation of CM11–CM21.

- *CM1 Water Facilities and Operations*: Construction of the Alternative 4 water conveyance facilities would result in the temporary disturbance of 3,531 acres that would provide opportunities for colonization by invasive plant species.
- *CM2 Yolo Bypass Fisheries Enhancements*: Construction of the Yolo Bypass fisheries enhancements would result in the temporary disturbance of 758 acres that would provide opportunities for colonization by invasive plant species. Vegetation maintenance activities for the Fremont Weir and Yolo Bypass improvements may include the removal of giant reed; however, the clearing of linear areas to facilitate water flow may also result in increased

opportunities for invasion. Sediment removal, transportation, and application as a source material for restoration or levee projects as part of Fremont Weir and Yolo Bypass maintenance activities could also result in the spread of invasives if the sediment contains viable invasive plant propagules.

- *CM3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in the eleven CZs would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *CM4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the BDCP Implementation Office would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the BDCP Implementation Office would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the temporary disturbance of 1,285 acres along channels in the north, east, and south Delta (San Joaquin, Old, and Middle Rivers) that would provide opportunities for colonization by invasive plant species.
- *CM6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.
- *CM7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *CM8 Grassland Natural Community Restoration*: The restoration of grassland habitat in CZs 1, 8, and/or 11 would result in the temporary disturbance of degraded grassland or cultivated land that would provide opportunities for colonization by invasive plant species.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes in CZs 1, 8, or 11 would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of agricultural lands in CZs 2 and 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the

establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.

- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoils, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of CM11, AMM4, AMM10, and AMM11.

CM11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the BDCP reserve system to reduce competition on native species, thereby improving conditions for covered species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10, and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would involve the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would involve methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the BDCP Implementation Office would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed ~~of~~ to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the other CMs, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any BDCP restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the Plan Area. Cleaning stations would be established at the perimeter of BDCP covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

NEPA Effects: The implementation of AMM4, AMM10, and AMM11, and CM11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

CEQA Conclusion: Under Alternative 4, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing the BDCP would not result in the long-term degradation of a sensitive natural community. With implementation of AMM4, AMM10, AMM11 and CM11, the temporary disturbance of land associated with the alternative would be offset and would not result in substantial alteration of site conditions. Therefore, the impact would be considered less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Conservation Measures with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities (CM1) and implementing CM2–CM21 for Alternative 4 have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 4 would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 4 on terrestrial biological resources are addressed in the impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the BDCP.

Federal and State Legislation

- The federal *Clean Water Act*, *Endangered Species Act*, *Fish and Wildlife Coordination Act*, *Migratory Bird Treaty Act*, *Rivers and Harbors Act* and *Marine Mammal Protection Act* all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decisionmaking. The biological goals and objectives contained in the BDCP that provide the major guidance for implementing the various conservation elements of Alternative 4 are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the Plan Area. While some of the conservation measures of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term guidance in the Plan would provide for the long-term viability and expansion of the habitats and special-status species populations in the Plan Area. Alternative 4 conservation actions would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.

- The *California Endangered Species Act*, *California Native Plant Protection Act*, *Porter-Cologne Water Quality Control Act*, and *Natural Communities Conservation Planning Act* are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. The BDCP, which is the basis for Alternative 4, contains biological goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 4 conservation actions would be compatible with the policies and directives contained in these laws.
- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are BDCP proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The BDCP biological goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).
- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. The BDCP and its plans for protection and restoration of tidal marsh habitats in Suisun Marsh would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The BDCP is intended to become a component of the Delta Plan. The Delta Stewardship Council will determine whether the BDCP is compatible with the goals and objectives of the Delta Plan prior to its incorporation into the Plan. The compatibility of the BDCP with the Delta Plan is considered in detail in Chapter 13, Section 13.2.2.2, *The Delta Plan*.
- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. The BDCP conservation measures that provide for a significant expansion of wetland acreage and quality in the Delta and Suisun Marsh are compatible with the intent of the California Wetlands Conservation Policy.
- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved

by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The BDCP Plan Area includes all or portions of three Implementation Plan basins—the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

Implementation of the Alternative 4 conservation measures would result in significant reductions in cultivated land and managed wetland acreage in the Delta, Yolo and Suisun basins; however, significant increases in tidal and nontidal wetlands in these basins would be another result. Because of the large conversion of managed wetland in the Suisun basin, the BDCP has included a large managed wetland conservation and enhancement goal for this area. For the Suisun basin conversions to be compatible with the 2006 Implementation Plan goals, this EIR/EIS has added mitigation that would require food production studies and adaptive management to ensure that the Suisun basin would continue to provide the waterfowl and shorebird habitat envisioned in the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, *Yolo Bypass Wildlife Area Land Management Plan*, *Grizzly Island Wildlife Area Management Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 4, especially construction of CM1 and CM2 facilities, and land modification associated with CM4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The proposed locations of the intermediate forebay and the RTM area on Zacharias Island fall within the Stone Lakes Cooperative Wildlife Management Area identified in the Stone Lakes Wildlife Refuge Comprehensive Conservation Plan (CCP). The primary objective of the Cooperative Wildlife Management Area is to maintain lands in private ownership and continue agricultural production but also allow USFWS to pursue a number of approaches to conserve and manage lands, depending on the preferences of willing landowners. The location of the intermediate forebay is an area that is entirely planted in vineyard, which has very little to no habitat value for wildlife species. The RTM area is used for hay or grain production, which does have high value for wildlife species. The placement of these project activities in these areas would be in conflict with the CCP.

  The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the BDCP would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Yolo Bypass, on Sherman Island, and in Suisun Marsh would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. The SMPA was signed in 1987 and modified in 2005 by DWR, CDFW, Reclamation and the Suisun Resource Conservation District to establish the mitigation approach in the Marsh for effects of operating the SWP and CVP. The primary concerns were the effects of CVP and SWP Delta diversions on salinity in the Marsh. The SMPA focused on ways to ensure adequate water quality and quantity for the managed wetlands and wildlife habitats in the Marsh to assure equal waterfowl values in the Marsh. The Suisun Marsh Plan, for which a Final EIS/EIR was released in 2010 by these agencies, provides for restoration of tidal marsh habitat and enhancement of managed wetland in the Marsh, maintenance of waterfowl hunting and recreational opportunities in the Marsh, maintenance and improvement of the Marsh levee system, and protection and enhancement of water quality for beneficial uses of the Marsh. An integral component of the Suisun Marsh Plan is balancing continued managed wetland operation with new tidal wetland restoration to provide improved and greater habitat for fish and wildlife species. The Suisun Marsh Plan is a programmatic, long-term plan and does not include specific projects, project proponents, or funding mechanisms. However, the Suisun Marsh Plan relies on tidal restoration to allow for managed wetland operations to continue. The BDCP would provide a funding mechanism and increased management potential relative to existing and restored habitats, assisting the Suisun Marsh Plan in meeting its broader ecological goals, consistent with long-term operation of the SWP and CVP water conveyance facilities. The conservation actions contained in the BDCP, which are designed to ensure the long-term protection and recovery of special-status fish and wildlife species dependent on the Marsh, would be compatible with the water quality and habitat restoration goals of the SMPA and Suisun Marsh Plan.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the Plan's long-term control and management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that Plan objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of BDCP's conservation actions would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 4 would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans and Natural Community Conservation Plans* are the subject of a detailed analysis at the end of this chapter. The analysis considers the compatibility of the BDCP with all HCPs and NCCPs that share planning area with the BDCP Plan Area.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The BDCP proposes to protect, enhance and expand the wetlands of the Plan Area, and, therefore, would be compatible with Executive Order 11990.

- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 4 construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of mitigation measures described in this chapter would be capable of making Alternative 4 implementation compatible with Executive Order 13112.
- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 4 conservation measures that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion conservation measures of Alternative 4 would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

***NEPA Effects*:** The potential plan and policy incompatibilities of implementing Alternative 4 identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the *Shorebirds and Waterfowl* analysis above, and no additional NEPA effects determination is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Chapter 13, Section 13.2, *Regulatory Setting*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

***CEQA Conclusion*:** The potential plan and policy incompatibilities of implementing Alternative 4 identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of large acreages of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the Shorebirds and Waterfowl analysis above, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Chapter 13, Section 13.2.3, *Local and Regional Plans, Policies, and Regulations*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

12.3.3.10 Alternative 5—Dual Conveyance with Pipeline/Tunnel and Intake 1 (3,000 cfs; Operational Scenario C)

Alternative 5 proposes construction of only one Sacramento River intake in the north Delta (see Section 3.5.10 in Chapter 3, *Description of Alternatives*, for a complete description of this alternative). Intake 1 would be constructed just across the river and upstream of Clarksburg. A tunnel would be constructed to connect this lone intake and pump station to the forebay located immediately east of Courtland (see Figure 3-2 in Chapter 3). The remainder of the construction associated with Alternative 5 would be the same as Alternatives 1A, 2A, 3, 6A, 7, and 8 that rely on a western tunnel alignment under Andrus and Tyler Islands to transport Sacramento River water across the Delta to the south Delta canals (see Table 12-5-1). For this reason, Alternative 5 is considered here in a summary fashion; the reader is referred to Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 5. The impacts associated with Alternatives 1A and 5 were derived by comparing the alternatives to the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

Alternative 5 would be operated under Operational Scenario C, which involves north Delta operations as proposed for Alternative 1A and south Delta operations directed by existing biological opinions from USFWS and NMFS. Scenario C includes the additional Delta outflow requirements associated with Scenarios B, D, E, F, and G. These requirements result in larger Delta outflows during September through November of certain water years.

Alternative 5 proposes a significant deviation in the re-establishment of tidal marsh as compared with all of the other BDCP alternatives. Tidal marsh restoration (CM4) would be limited to 25,000 acres for Alternative 5 as opposed to the 65,000 acres proposed for all other BDCP alternatives. The restoration activities would be limited to what is proposed during the first 15 years for the other options. The 40,000-acre reduction would have significant implications for cultivated lands and managed wetland conversion (see Table 12-5-2).

Note that the acres of habitat affected by CM1, as listed in Table 12-5-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-5-3 and Table 12-5-4 for the late long-term timeframe are acres that would be affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures.

Comparative Differences in CM1 Construction Effects for Alternatives 5 and 1A

With only one intake and pump station located in the north Delta, Alternative 5 would create significant differences in the permanent and temporary loss of natural communities and cultivated lands during water conveyance facilities construction when compared with alternatives having five intakes along the Sacramento River (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 6A, 6B, and 6C). The relative differences in direct loss of habitat between Alternative 5 and Alternative 1A are included in Table 12-5-1. All of these differences would occur during the near-term timeframe associated with water conveyance facilities construction along and just east of the Sacramento River between Clarksburg and Courtland. Alternative 5 would permanently remove 13 fewer acres of tidal perennial aquatic habitat in the Sacramento River, 12 fewer acres of valley/foothill riparian habitat along the eastern bank of the Sacramento River, 21 fewer acres of grassland along and behind the levees of the river, and 166 fewer acres of cultivated land immediately east of the river (Table 12-5-1). Alternative 5 would also permanently affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (14 acres fewer; see Table 12-5-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary impacts on jurisdictional waters and wetlands.

Alternative 5 also would result in significantly fewer temporary losses of natural communities, including reduced losses of tidal perennial aquatic (49 acres less), valley/foothill riparian (11 acres less), grassland (27 acres less), tidal freshwater emergent wetland (3 acres less), and cultivated lands (461 acres less) when compared with Alternative 1A (Table 12-5-1). Alternative 5 would temporarily affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (57 acres fewer; see Table 12-5-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

These differences in loss of natural communities associated with CM1 construction would create differences in effects on covered and noncovered wildlife species. The reduced level of valley/foothill riparian habitat loss would be a positive influence on valley elderberry longhorn beetle, breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, Cooper's hawk, white-tailed kite, and black-crowned night heron), and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. Species that would benefit from smaller permanent losses of grassland and cultivated land would include foraging raptors (Swainson's hawk, short-eared owl, northern harrier, merlin and white-tailed kite), greater sandhill crane, mountain plover, California horned lark, tricolored blackbird and several species of bats. Alternative 5 would result in a smaller permanent loss (116 acres less) of crane foraging habitat compared to Alternative 1A. The significantly smaller temporary habitat conversions associated with Alternative 5 would have comparable benefits to these species during the construction period. There would be 323 fewer acres of foraging habitat temporarily lost under Alternative 5 for greater sandhill crane than under Alternative 1A because of the lower acreage of cultivated land loss.

The differences in effects that construction of the water conveyance facilities associated with Alternatives 1A and 5 could have on special-status plant species are extremely minor. Habitat modeling indicates that Alternative 5 would result in smaller permanent losses of habitat associated with side-flowering skullcap (1 acre less), Mason's lilaeopsis (5 acres less) and delta mudwort (5 acres less), when compared with Alternative 1A. Similar small differences would result from temporary construction effects (6 acres less effect on Mason's lilaeopsis and delta mudwort habitat with Alternative 5).

The near-term conservation activities described in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for conservation, enhancement and replacement of habitats affected by the early water conveyance facility construction activities. This conservation activity, which is part of the early implementation of the BDCP, would offset water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Table 12-5-1. Alternative 5 Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

		Conveyance Option		Conveyance Option	
Natural Community	Total Existing Habitat in Study Area	Alternative 5 Removed Habitat (Permanent)[b]	Difference from Alternative 1A	Alternative 5 Removed Habitat (Temporary)[c]	Difference from Alternative 1A
Tidal perennial aquatic[a]	86,263	35	-13	84	-49
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	3	-3
Valley/foothill riparian	17,966	47	-11	17	-11
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	294	-21	235	-27
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	3,657	-179	1,730	-461

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas.

Table 12-5-2 Alternative 5 Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1A (acres)

	Alternative 5 Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1A	Temporary Impact	Difference from Alternative 1A
Agricultural Ditch	64.8	-0.1	20.7	-2.7
Alkaline Wetland	0.1	0	0	0
Clifton Court Forebay	1.0	0	0	0
Conveyance Channel	12.7	0	1.1	0
Depression	1.9	0	1.5	-0.3
Emergent Wetland	46.8	0	4.7	-2.5
Forest	5.7	-0.1	10.9	-1.0
Lake	0	0	0	-0.3
Scrub-Shrub	18.2	-2.4	1.9	-2.4
Seasonal Wetland	18.7	0.0	26.6	0.0
Tidal Channel	31.4	-11.6	86.3	-47.5
Vernal Pool	0	0	0	0
Total	**201**	**-14**	**154**	**-57**

Effects of Restoration-Related Conservation Actions of Alternative 5

The natural communities and managed land conversions associated with the major restoration-related conservation measures under Alternative 5 (CM2, CM4, and CM5, CM7, CM8, CM10, and CM18) present the greatest potential to affect both covered and noncovered plants and wildlife in the study area. Most of these restoration-related conservation measures (CM2, CM7, CM8, and CM10) would be identical to the other BDCP alternatives. However, for *CM4 Tidal Natural Communities Restoration*, Alternative 5 would result in a much smaller conversion of natural habitats, managed wetlands and cultivated lands. Table 12-5-3 lists the permanent and temporary natural community and managed land conversions associated with CM2, CM4, and CM5 for Alternative 5. These losses would be a significant reduction in the acreage of managed wetland (6,445 acres fewer) and cultivated lands (28,142 acres fewer) that would be converted through tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) habitat restoration when compared with the other BDCP alternatives. There would be less dramatic reductions in the conversion of tidal (42 acres fewer) and nontidal (169 acres fewer) aquatic and wetland habitats, grassland (390 acres fewer) and valley/foothill riparian habitat (49 acres fewer). Table 12-5-4 presents permanent and temporary natural community effects under other conservation measures. These measures would restore large areas of grassland (CM8), valley/foothill riparian (CM7), and nontidal marsh (CM10) habitats to compensate for the conversions associated with tidal marsh and floodplain restoration, but these other measures would be implemented through the course of the BDCP restoration program. None of these measures includes subsequent expansions of cultivated lands.

Table 12-5-3. Alternative 5 Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	16	0	2	5
Tidal brackish emergent wetland	0	0	0	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	403	0	43	35
Nontidal perennial aquatic	24	12	68	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	51	0	0	0
Alkali seasonal wetland complex	45	0	13	0	0	0
Vernal pool complex	0	0	269	0	0	0
Managed wetland	24	44	7,301	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	338	239	732	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	11,423	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Yolo Bypass Fisheries Enhancement.

[c] Tidal Natural Communities Restoration.

[d] Seasonally Inundated Floodplain Restoration.

[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.

[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-5-4. Alternative 5 Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

The 25,000-acre expansion of tidal wetland habitats would occur during the course of the BDCP restoration program. The conversions indicated in Table 12-5-3 include a permanent conversion of 16 acres of tidal perennial aquatic, 1 acre of tidal freshwater emergent wetland, 403 acres of valley/foothill riparian, 732 acres of grassland, 13 acres of alkali seasonal wetland complex, 269 acres of vernal pool complex, and 68 acres of nontidal perennial aquatic natural communities. Larger acreages of managed wetland (7,301 acres) and cultivated land of various types (11,423 acres) would be converted. These conversions would occur in multiple conservation zones, but would be focused in CZs 1, 2, 4, 5 and 11 (see Figure 12-1). Suisun Marsh (CZ 11) would undergo significant conversion of managed wetland while the Cosumnes-Mokelumne area (CZ 4) would have mostly cultivated lands converted. Riparian habitat losses would occur in multiple conservation zones, while grassland conversion would occur primarily in the Yolo Bypass (CZ 2) and the west Delta (CZ 5). Vernal pool inundation would occur in the Cache Slough (CZ 1) and Suisun Marsh (CZ 11) areas.

This removed habitat supports various life stages of many covered and noncovered species that are found in the study area (see Tables 12-2 and 12-3 in Section 12.1.3, *Special-Status Species*). The loss of managed wetland in the Suisun Marsh area would affect some common waterfowl that prefer freshwater wetlands and prefer the water depths associated with lands that are managed to attract waterfowl. Other species that occupy Suisun Marsh managed wetlands would also be able to occupy the tidal marsh habitats developed as part of CM4. The conversion of valley/foothill riparian habitat would influence special-status species such as valley elderberry longhorn beetle, breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, Coopers hawk, and black-crowned night heron), and migratory habitat for species that use the riparian corridors, such as western yellow-billed cuckoo. The potential for loss of vernal pool complex through tidal inundation would affect numerous special status fairy shrimp and potentially western spadefoot and California tiger salamander. Grassland conversion would affect foraging for raptors and some passerines, such as loggerhead shrike, tricolored blackbird and grasshopper sparrow. The large acres of converted cultivated land in Cosumnes-Mokelumne area, the west Delta and the Yolo Bypass would affect a variety of species, including raptors, greater sandhill crane, tricolored blackbird, and potentially giant garter snake and western pond turtle.

The reader is referred to the Alternative 1A impact analysis above for the broader discussion of overall terrestrial biological resources effects that would result from implementation of Alternative 5, beyond only the effects of tidal marsh restoration. The principal effects of concern associated with both Alternative 1A and 5 are related to the conversion of large acreages of cultivated lands and managed wetland to tidal marsh and other habitat types during restoration activities. All of the permanent habitat loss associated with Alternative 5 would take place through the course of implementing the BDCP. The BDCP conservation components are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

NEPA Effects**:** Alternative 5 would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 5 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

CEQA Conclusion**:** Alternative 5 would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 5 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

As with Alternative 1A, Alternative 5 would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 5 AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.11 Alternative 6A—Isolated Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario D)

Alternative 6A would affect terrestrial biological resources in the same manner as Alternative 1A. Alternative 6A, which is fully described in Section 3.5.11 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-2 in Chapter 3, would employ the same construction footprint and include the same suite of conservation components as Alternative 1A. For this reason, Alternative 6A is considered here in a summary fashion; the reader is referred to Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 6A. The impacts associated with Alternatives 1A and 6A were derived by comparing the alternatives to the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

The only difference between the two alternatives is the operational scenario that is proposed. Alternative 6A would use Operational Scenario D rather than Operational Scenario A. Scenario D calls for the pipeline and tunnel to act as an isolated conveyance facility. All water destined for the CVP and SWP canals in the south Delta would be diverted in the north Delta and transported south through the pipeline and tunnel. The pumping of water directly from south Delta channels would no longer occur. Operational Scenario D also provides for an increased Delta outflow during September and October of some water years. These water operations would have no significant effect on terrestrial biological resources in the study area.

The reader is referred to the Alternative 1A impact analysis for the broader discussion of overall terrestrial biological resources effects that would result from implementation of Alternative 6A. The Alternative 6A water conveyance facilities construction effects on natural communities are included in Table 12-6A-1. The principal effects of concern associated with both Alternative 1A and 6A are related to the conversion of large acreages of cultivated lands and managed wetland to water conveyance facilities (CM1; Table 12-6A-1), and to tidal marsh and other habitat types (CM2, CM4, and CM5—Table 12-6A-2; CM7, CM8, CM10, and CM18—Table 12-6A-3). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

Note that the acres of habitat affected by CM1, as listed in Table 12-6A-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-6A-2 and Table 12-6A-3 for the late long-term timeframe are acres that would be affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures.

These effects accrue to special-status species and common wildlife species that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and passerines and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activities (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Table 12-6A-1. Alternative 6A Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

		Conveyance Option		Conveyance Option	
Natural Community	Total Existing Habitat in Study Area	Alternative 6A Removed Habitat (Permanent)[b]	Difference from Alternative 1A	Alternative 6A Removed Habitat (Temporary)[c]	Difference from Alternative 1A
Tidal perennial aquatic[a]	86,263	48	0	133	0
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	6	0
Valley/foothill riparian	17,966	58	0	28	0
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	315	0	262	0
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	3,836	0	2,191	0

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas

[c] Features in this category include the following conveyance features: Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area and Borrow/Spoil Areas.

1 **Table 12-6A-2. Alternative 6A Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that**
2 **Affect Most Natural Communities (acres)**

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

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Table 12-6A-3. Alternative 6A Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

Some of the permanent habitat loss associated with these alternatives would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) and other natural communities. The BDCP conservation components are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

NEPA Effects: Alternative 6A would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 6A would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects because the affects to terrestrial resources are exactly the same.

CEQA Conclusion: Alternative 6A would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 6A would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects because the affects to terrestrial resources are exactly the same.

As with Alternative 1A, Alternative 6A would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 6A AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat

- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.12 Alternative 6B—Isolated Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario D)

Alternative 6B would affect terrestrial biological resources in the same manner as Alternative 1B. Alternative 6B, which is described fully in Section 3.5.12 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-4 in Chapter 3, would employ the same construction footprint and contain the same suite of conservation components as Alternative 1B. For this reason, Alternative 6B is considered here in a summary fashion; the reader is referred to Alternative 1B for a detailed description of impacts that would be associated with implementing Alternative 6B. The impacts associated with Alternatives 1B and 6B were derived by comparing the alternatives with the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

The only difference between the two alternatives is the operational scenario that is proposed. Alternative 6B would use Operational Scenario D rather than Operational Scenario A. Scenario D calls for the eastern canal to act as an isolated conveyance facility. All water destined for the CVP and SWP canals in the south Delta would be diverted in the north Delta and transported south through the eastern canal. The pumping of water directly from south Delta channels would no longer occur. Operational Scenario D also provides for an increased Delta outflow during September and October of some water years. These water operations would have no significant effect on terrestrial biological resources in the study area.

The Alternative 6B water conveyance facilities construction effects on natural communities are included in Table 12-6B-1. The principal effects of concern associated with both Alternative 1B and 6B are related to the conversion of large acreages of cultivated lands and managed wetland to water conveyance facilities(Table 12-6B-1), tidal marsh and other habitat types (Table 12-6B-2 and Table 12-6B-3). Refer to Table 12-1B-68 for a summary of Alternative 1B permanent and temporary jurisdictional waters and wetlands impacts.

Note that the acres of habitat affected by CM1, as listed in Table 12-6B-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-6B-2 and Table 12-6B-3 for the late long-term timeframe are acres affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures.

The major habitat conversions associated with Alternatives 1B and 6B accrue to special-status species and common wildlife species that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and passerines and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activities (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Table 12-6B-1. Alternative 6B Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

Natural Community	Total Existing Habitat in Study Area	Conveyance Option: Alternative 6B Removed Habitat (Permanent)[b]	Conveyance Option: Difference from Alternative 1B	Conveyance Option: Alternative 6B Removed Habitat (Temporary)[c]	Conveyance Option: Difference from Alternative 1B
Tidal perennial aquatic[a]	86,263	33	0	145	0
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	8	0	11	0
Valley/foothill riparian	17,966	51	0	39	0
Nontidal perennial aquatic	5,567	19	0	5	0
Nontidal freshwater perennial emergent wetland	1,509	5	0	6	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	0	0	0	0
Managed wetland	70,798	4	0	18	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	400	0	358	0
Inland dune scrub	19	0	0	0	0
Cultivated land	487,106	7,886	0	12,551	0

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Canal, Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas.

Some of the permanent habitat loss associated with these alternatives would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland; CM4) and other natural communities (CM2 and CM5, Table 12-6B-2; CM7, CM8, CM10, and CM18, Table 12-6B-3). The BDCP conservation components are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

Table 12-6B-2. Alternative 6B Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1.	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration
[d] Seasonally Inundated Floodplain Restoration
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-6B-3. Alternative 6B Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated land	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

NEPA Effects**:** Alternative 6B would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area except for an adverse effect on giant garter snake population connectivity and on wildlife movement corridors in general. The construction of the canal would substantially inhibit the movement of giant garter snakes and other wildlife from moving within and outside of the Delta. This alternative would not significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1B, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of the water conveyance canal from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize adverse effects to the maximum extent practicable. Alternative 6B would not require mitigation measures beyond what is proposed for Alternative 1B to offset effects.

CEQA Conclusion**:** Alternative 6B would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area except for giant garter snake habitat connectivity, or to wildlife movement corridors in general. The construction of the canal would substantially inhibit the movement of giant garter snakes and other wildlife from moving within and outside of the Delta. The alternative would not increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1B, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize significant impacts. Alternative 6B would not require mitigation measures beyond what is proposed for Alternative 1B to offset effects. Despite these measures, there would remain significant and unavoidable impacts on giant garter snake population connectivity and wildlife movement corridors from Alternative 6B.

As with Alternative 1B, Alternative 6B would require several mitigation measures to be adopted to reduce effects on terrestrial biological resources to less-than-significant levels when possible. These mitigation measures would be needed beyond the impact offsets provided by Alternative 6B AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1B, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-50a: Provide Connectivity between Coldani Marsh/White Slough Population and the Giant Garter Snake's Historical Range
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-69b: BDCP-Related Construction Will Not Result in A Net Decrease in Crane Use Days on Bract Tract
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat

- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.13 Alternative 6C—Isolated Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario D)

Alternative 6C would affect terrestrial biological resources in the same manner as Alternative 1C. Alternative 6C, which is described fully in Section 3.5.13 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-6 in Chapter 3, would employ the same construction footprint and include the same suite of conservation components as Alternative 1C. For this reason, Alternative 6C is considered here in a summary fashion; the reader is referred to Alternative 1C for a detailed description of impacts that would be associated with implementing Alternative 6C. The impacts associated with Alternatives 1C and 6C were derived by comparing the alternatives with the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

The only difference between the two alternatives is the operational scenario that is proposed. Alternative 6C would use Operational Scenario D rather than Operational Scenario A. Scenario D calls for the western canal and tunnel to act as an isolated conveyance facility. All water destined for the CVP and SWP canals in the south Delta would be diverted in the north Delta and transported south through the western canal and tunnel. The direct pumping of water from south Delta waterways would no longer occur. Operational Scenario D also provides for an increased Delta outflow during September and October of some water years. These water operations would have no significant effect on terrestrial biological resources in the study area.

CM1 Construction Effects for Alternative 6C

The Alternative 6C water conveyance facilities construction effects on natural communities are included in Table 12-6C-1. The principal effects of concern associated with both Alternative 1C and 6C are related to the conversion of large acreages of cultivated lands, managed wetland, grassland, vernal pool complex and alkali seasonal wetland complex to water conveyance facilities (Table 12-6C-1). Refer to Table 12-1C-68 for a summary of Alternative 1C permanent and temporary jurisdictional waters and wetlands impacts.

Note that the acres of habitat affected by CM1, as listed in Table 12-6C-1, would be acres affected in the near-term timeframe, or the first 10 years of Plan implementation. The acres represented in Table 12-6C-2 and Table 12-6C-3 for the late long-term timeframe are acres that would be affected cumulatively over the entire 50-year period of the Plan. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures.

Construction of the Alternative 6C canal and tunnel in the western Delta and west and northwest of Clifton Court Forebay would have significant impacts on cultivated lands, and grassland, vernal pool and alkali seasonal wetland natural communities. The large acreages of vernal pool and alkali seasonal wetland impacted near Clifton Court Forebay would exceed the offsetting restoration and protection included in the BDCP, so additional mitigation would be required. These effects accrue to special-status species and common wildlife species that rely on cultivated land, grassland, vernal pool complex and alkali seasonal wetland complex during some life stage. Foraging raptors and passerines and some waterbirds are regular inhabitants of the Delta's cultivated lands. Grassland habitats also provide foraging for raptors and passerines, and upland habitat for some mammals and amphibians. Vernal pools provide habitat to special-status crustaceans, California tiger salamander, numerous common waterbirds, and a suite of special-status plants. Alkali seasonal wetland complex provides habitat to California tiger salamander, numerous common waterbirds, foraging raptors and its own suite of special-status, salt tolerant plants.

The near-term conservation activities described in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, and the mitigation measures proposed in the Alternative 1C analysis would provide for conservation, enhancement and replacement of habitats affected by the early water conveyance facility construction activities of Alternative 6C. This conservation activity, which is part of the early implementation of the BDCP, would offset most water conveyance facilities construction effects on both covered and noncovered special-status species in the study area. As indicated above, additional mitigation would be required for species reliant on vernal pool complex and alkali seasonal wetland complex natural communities.

Table 12-6C-1. Alternative 6C Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

Natural Community	Total Existing Habitat in Study Area	Conveyance Option: Alternative 6C Removed Habitat (Permanent)[b]	Conveyance Option: Difference from Alternative 1C	Conveyance Option: Alternative 6C Removed Habitat (Temporary)[c]	Conveyance Option: Difference from Alternative 1C
Tidal perennial aquatic[a]	86,263	25	0	117	0
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	0	0	1	0
Valley/foothill riparian	17,966	40	0	86	0
Nontidal perennial aquatic	5,567	22	0	21	0
Nontidal freshwater perennial emergent wetland	1,509	0	0	5	0
Alkali seasonal wetland complex	3,723	13	0	9	0
Vernal pool complex	12,133	29	0	37	0
Managed wetland	70,798	1	0	145	0
Other natural seasonal wetland	842	2	0	2	0
Grassland	78,047	358	0	320	0
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	6,073	0	9,481	0

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Canal, Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Canal Work Area, Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas.

1 **Table 12-6C-2. Alternative 6C Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that**
2 **Affect Most Natural Communities (acres)**

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Tidal perennial aquatic[a]	8	11	58	0	2	5
Tidal brackish emergent wetland	0	0	0	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

3

Table 12-6C-3. Alternative 6C Late Long-Term Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

Effects of Restoration-Related Actions of Alternative 6C

Some of the permanent habitat loss associated with Alternative 6C would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some natural communities (cultivated lands, managed wetland, alkali seasonal wetland complex, grassland and valley/foothill riparian) are converted to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) and other natural communities as part of restoration actions (CM2, CM4, and CM5; Table 12-6C-2; CM7, CM8, CM10, and CM18; Table 12-6C-3). The large acreages of cultivated land and managed wetland converted during marsh, grassland and riparian habitat restoration would affect species similar to those described above for losses associated with CM1, only on a larger scale. The BDCP restoration-related conservation components are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

***NEPA Effects*:** Alternative 6C would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study. The construction of the canal and associated infrastructure would substantially inhibit the movement of wildlife from moving within and outside of the Delta resulting in an adverse effect. This alternative would not significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1C, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of the water conveyance canal from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize adverse effects to the maximum extent practicable. Alternative 6C would not require mitigation measures beyond what is proposed for Alternative 1C to offset effects.

CEQA Conclusion: Alternative 6C would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study. The construction of the canal and associated infrastructure would substantially inhibit the movement of wildlife from moving within and outside of the Delta resulting in an adverse effect. The alternative would not increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1C, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid and minimize significant impacts. Alternative 6C would not require mitigation measures beyond what is proposed for Alternative 1C to offset effects. Despite these measures, there would remain a significant and unavoidable impact on wildlife movement corridors from Alternative 6C.

As with Alternative 1C, Alternative 6C would require several mitigation measures to be adopted to reduce effects on terrestrial biological resources to less-than-significant levels when possible. These mitigation measures would be needed beyond the impact offsets provided by Alternative 6C AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1C, are as follows:

- Mitigation Measure BIO-18: Compensate for Loss of Alkali Seasonal Wetland Complex
- Mitigation Measure BIO-27: Compensate for Loss of Other Natural Seasonal Wetland
- Mitigation Measure BIO-32: Restore and Protect Vernal Pool Crustacean Habitat
- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-91a, Compensate for Permanent Loss of Low-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-121: Compensate for Loss of Short-Eared Owl and Northern Harrier Nesting Habitat
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.14 Alternative 7—Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Enhanced Aquatic Conservation (9,000 cfs; Operational Scenario E)

The water conveyance facilities construction elements (CM1) of Alternative 7 would affect terrestrial biological resources in a nearly identical fashion to Alternative 1A. The principal differences between Alternative 7, which is described fully in Section 3.5.14 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-2 in Chapter 3, and Alternative 1A are related to the differing construction footprints. For this reason, Alternative 7 is considered here in a summary fashion; the reader is referred to Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 7. The impacts associated with Alternatives 1A and 7 were derived by comparing the alternatives with the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

The Alternative 7 water conveyance facilities would entail construction at north Delta Intakes 2, 3, and 5 rather than 1–5. The locations of these intakes are depicted in Figure 3-2 in Chapter 3. Eliminating Intakes 1 and 4 would reduce the construction footprint along the eastern bank of the Sacramento River just north of Clarksburg and immediately south of Hood. The operational scenario for Alternative 7 (Scenario E) is also different from Alternative 1A (Operational Scenario A), but this change would not significantly alter terrestrial biological resources effects. Alternative 7 operations would extract water from the river at the three intakes and would require additional pumping at the south Delta pumps. Also, Operational Scenario E would involve greater Delta freshwater outflows during September, October and November of some water years when compared with Operational Scenario A.

Alternative 7 would include the same conservation activities as Alternative 1A beyond CM1 with two exceptions. *CM6 Channel Margin Enhancement* would include restoration and enhancement activities along 40 miles of river channel in the Delta rather than the 20 miles proposed for all other BDCP alternatives. Also, *CM5 Seasonally Inundated Floodplain Restoration* would expand from 10,000 acres to 20,000 acres under Alternative 7. These expansions would have major positive impacts on valley/foothill riparian natural community along major Delta waterways; at the same time, other natural communities and cultivated land would experience reductions as riparian habitats are enhanced and expanded.

Comparative Differences in CM1 Construction Effects for Alternatives 7 and 1A

Because of the elimination of Intakes 1 and 4 and their associated pumps and pipelines, Alternative 7 would create relatively small differences in the permanent and temporary loss of natural communities and cultivated lands during water conveyance facilities construction when compared with Alternative 1A (Table 12-7-1). All of these differences would occur during the near-term timeframe associated with water conveyance facilities construction. Alternative 7 would permanently remove 7 fewer acres of tidal perennial aquatic habitat in the Sacramento River, 10 fewer acres of valley/foothill riparian habitat along the eastern bank of the Sacramento River, and 5 fewer acres of grassland along the river levees. These reductions would occur as a result of not constructing Intakes 1 and 4 on the east bank of the Sacramento River. There would also be a reduction in loss of cultivated lands (95 fewer acres) east of the river near these intake sites. Alternative 7 would also permanently affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (7 acres fewer;

see Table 12-7-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

Table 12-7-1. Alternative 7 Near-Term Effects of Water Conveyance Facilities (CM1) on Natural Communities (acres)

		Conveyance Option		Conveyance Option	
Natural Community	Total Existing Habitat in Study Area	Alternative 7 Removed Habitat (Permanent)[b]	Difference from Alternative 1A	Alternative 7 Removed Habitat (Temporary)[c]	Difference from Alternative 1A
Tidal perennial aquatic[a]	86,263	41	-7	108	-25
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	5	-1
Valley/foothill riparian	17,966	48	-10	25	-3
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	305	-5	255	-7
Inland dune scrub	19	0	0	0	0
Cultivated lands	487,106	3,741	-95	1,977	-214

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas.

Table 12-7-2 Alternative 7 Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1A (acres)

	Alternative 7 Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1A	Temporary Impact	Difference from Alternative 1A
Agricultural Ditch	64.6	-0.3	21.9	-1.6
Alkaline Wetland	0.1	0	0	0
Clifton Court Forebay	1.0	0	0	0
Conveyance Channel	12.7	0	1.1	0
Depression	1.9	0	0.4	-1.3
Emergent Wetland	46.8	0	6.7	-0.6
Forest	5.6	-0.1	10.8	-1.1
Lake	0	0	0.3	0
Scrub-Shrub	20.3	-0.3	3.3	-1.0
Seasonal Wetland	18.7	0	26.6	0
Tidal Channel	36.9	-6.1	109.6	-24.2
Vernal Pool	0		0	0
Total	**209**	**-6.8**	**181**	**-29.8**

During the water conveyance facilities construction process, Alternative 7 would also involve less temporary loss of habitat when compared with Alternative 1A. The difference would be reflected in reduced losses of tidal perennial aquatic (25 acres less), valley/foothill riparian (3 acres less), grassland (7 acres less), and cultivated land (214 acres less) when compared with Alternative 1A (Table 12-7-1). Alternative 7 would also temporarily affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (30 acres fewer; see Table 12-7-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

These differences in permanent loss of habitat from constructing the water conveyance facility would create differences in effects on covered and noncovered wildlife. The reduced level of valley/foothill riparian habitat loss would be a positive influence on valley elderberry longhorn beetle, breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, Cooper’s hawk, white-tailed kite, and black-crowned night heron), and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. Species that would benefit from smaller permanent losses of grassland and cultivated land would include foraging raptors (Swainson’s hawk, short-eared owl, northern harrier, merlin and white-tailed kite), greater sandhill crane, mountain plover, California horned lark, tricolored blackbird and several species of bats. Alternative 7 would permanently remove 85 fewer acres of greater sandhill crane foraging habitat when compared to Alternative 1A. The smaller temporary habitat conversions associated with Alternative 7 would have comparable benefits to these species.

The differences in effect that Alternatives 1A and 7 could have on special-status plant species are extremely minor. Habitat modeling indicates that Alternative 7 would create 5 fewer acres of habitat loss for Mason’s lilaeopsis and delta mudwort when compared with Alternative 1A.

The near-term conservation activities described in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, and the mitigation measures proposed in the Alternative 1A analysis would provide for protection, enhancement and restoration of habitats affected by the early water conveyance facility construction activities associated with Alternative 7. This conservation activity, which is part of the early implementation of the BDCP, would offset water conveyance facilities construction effects on both covered and noncovered special-status species in the study area.

Effects of Restoration-Related Actions of Alternative 7

The natural communities and managed land conversions associated with the restoration-related conservation measures of Alternative 7 present the greatest potential to affect both covered and noncovered plants and wildlife in the study area (CM2, CM4, and CM5—Table 12-7-3; CM7, CM8, CM10, and CM18—Table 12-7-4). Most of Alternative 7's other conservation measures (CM2, CM4, CM7, CM8, CM10, and CM18) are identical to the other BDCP alternatives described above. However, the seasonally inundated floodplain restoration (CM5) and channel margin enhancement (CM6) for Alternative 7 would be expanded compared with the other BDCP alternatives. The seasonally inundated floodplain restoration would be expanded by 10,000 acres and the channel margin habitat enhancement would be extended for another 20 linear miles. Both of these activities would extend valley/foothill riparian habitat adjacent to some of the Delta's major waterways, including the Sacramento, San Joaquin and Mokelumne Rivers, and Sutter and Steamboat Sloughs. The floodplain expansion would also allow for the introduction of wildlife-compatible cultivated land in the newly created floodplains.

The expansion of floodplain habitat would be accomplished through the course of the BDCP restoration program. During that period, setback of levees and other activities associated with the conservation components would permanently remove acreages from some natural communities. The permanent and temporary conversions for Alternative 7 are shown in Table 12-7-3 and Table 12-7-4. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures. The principal permanent losses would be in nontidal perennial aquatic, managed wetland, grassland and cultivated lands natural communities. These losses would affect plant and wildlife species associated with the habitats. Grassland and cultivated lands losses along the Delta waterways mentioned above would reduce foraging habitat for some special-status raptors (short-eared owl, Swainson's hawk, white-tailed kite, northern harrier, merlin, western burrowing owl), greater sandhill crane and tricolored blackbird; upland habitat for giant garter snake and riparian brush rabbit; and dispersal and upland nesting habitat for western pond turtle. The permanent loss of nontidal perennial aquatic habitat would affect aquatic habitat for giant garter snake and western pond turtle. The temporary removal of existing riparian habitat to move levees and prepare stream channels for replanting of riparian species would have a short-term effect on multiple species, including riparian woodrat, riparian brush rabbit, nesting raptors, valley elderberry longhorn beetle, yellow-breasted chat, western yellow-billed cuckoo, and western pond turtle.

Table 12-7-3. Alternative 7 Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	4	10
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	2	2
Valley/foothill riparian	89	88	552	0	86	70
Nontidal perennial aquatic	24	12	189	0	56	32
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	102	68
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	629	363	39,565	0	4,174	2,388

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Yolo Bypass Fisheries Enhancement.

[c] Tidal Natural Communities Restoration.

[d] Seasonally Inundated Floodplain Restoration; the acreages included for CM5 in this table were estimated by doubling the acreages calculated for CM5 for other BDCP alternatives. The CM5 acres for other BDCP alternatives were estimated based on a hypothetical footprint for the restoration action, but no similar footprint was developed for Alternative 7.

[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.

[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-7-4. Alternative 7 Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
Natural Community	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent.
Temp = Temporary.

A number of special-status plant species would have modeled habitat affected by the extension of seasonally inundated floodplain for Alternative 7. There would be permanent and temporary effects on this habitat. The habitat lost permanently includes 10 acres for slough thistle, 13 acres for delta button celery, 2 acres each for San Joaquin spearscale and side-flowering skullcap and 1 acre each for Mason's lilaeopsis and delta mudwort. Slightly larger acreages of habitat for these same species would be affected temporarily.

For a broader view of the overall effects of Alternative 7 beyond its unique effects associated with CM5 and CM6, the reader is referred to the Alternative 1A impact analysis earlier in this chapter. The principal effects of concern associated with both Alternative 1A and 7 are related to the conversion of large acreages of cultivated lands and managed wetland to tidal marsh and other habitat types. These effects accrue to special-status species and common wildlife species that rely on cultivated lands and managed wetlands during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activities (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Some of the permanent habitat loss associated with these alternatives would take place during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) and other natural communities. The BDCP conservation components are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

***NEPA Effects*:** Alternative 7 would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 7 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

***CEQA Conclusion*:** Alternative 7 would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 7 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

As with Alternative 1A, Alternative 7 would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 7 AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.15 Alternative 8—Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Increased Delta Outflow (9,000 cfs; Operational Scenario F)

Alternative 8, which is described fully in Section 3.5.15 of Chapter 3, *Description of Alternatives*, and depicted in Figure 3-2 in Chapter 3, would affect terrestrial biological resources in a nearly identical fashion to Alternative 1A. For this reason, Alternative 8 is considered here in a summary fashion; the reader is referred to Alternative 1A for a detailed description of impacts that would be associated with implementing Alternative 8. The impacts associated with Alternatives 1A and 8 were derived by comparing the alternatives with the No Action Alternative for NEPA purposes, and to Existing Conditions for CEQA purposes.

The principal differences between these two alternatives would be related to the differing construction footprints of the water conveyance facilities (CM1). The Alternative 8 water conveyance facilities would entail construction at north Delta Intakes 2, 3, and 5 rather than Intakes 1–5. The locations of these intakes are depicted in Figure 3-2 in Chapter 3, *Description of Alternatives*. Eliminating Intakes 1 and 4 would reduce the construction footprint along the eastern bank of the Sacramento River just north of Clarksburg and immediately south of Hood. The operational scenario for Alternative 8 (Scenario F) is also different from Alternative 1A (Scenario A), but this change would not significantly alter terrestrial biological resources effects. Alternative 8 operations would extract water from the river at the three intakes and would require additional pumping at the south Delta pumps. Also, Operational Scenario F would involve greater Delta freshwater outflows during September and October of some water years when compared with Operational Scenario A. All of the conservation measures other than CM1 would be the same as Alternative 1A.

Comparative Differences in CM1 Construction Effects for Alternatives 8 and 1A

Because of the elimination of Intakes 1 and 4 and their associated pumps and pipelines, Alternative 8 would create relatively small differences in the permanent and temporary loss of natural communities and cultivated land during water conveyance facilities construction when compared with Alternative 1A (Table 12-8-1). All of these differences would take place during the near-term timeframe associated with water conveyance facilities construction. Alternative 8 would permanently remove 7 fewer acres of tidal perennial aquatic habitat, 10 fewer acres of valley/foothill riparian habitat, and 5 fewer acres of grassland along the east bank of the Sacramento River. Alternative 8 would also remove 95 fewer acres of cultivated land east of the Sacramento River. Alternative 8 would also permanently affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (7 acres fewer; see Table 12-8-2). Refer to Table 12-1A-69 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands impacts.

During the water conveyance facilities construction process, Alternative 8 would involve less temporary loss of habitat when compared with Alternative 1A. There would be reduced losses of tidal perennial aquatic (25 acres less), tidal freshwater emergent wetland (1 acre less), valley/foothill riparian (3 acres less), grassland (7 acres less) and cultivated land (214 acres less) when compared with Alternative 1A (Table 12-8-1). Alternative 8 would also temporarily affect a smaller acreage of jurisdictional waters (including wetlands) as regulated by Section 404 of the CWA, when compared to Alternative 1A (30 acres fewer, see Table 12-8-2). Refer to Table 12-1A-69

1 for a summary of Alternative 1A permanent and temporary jurisdictional waters and wetlands
2 impacts.

3 **Table 12-8-1. Alternative 8 Near-Term Effects of Water Conveyance Facilities (CM1) on Natural**
4 **Communities (acres)**

Natural Community	Total Existing Habitat in Study Area	Conveyance Option: Alternative 8 Removed Habitat (Permanent)[b]	Conveyance Option: Difference from Alternative 1A	Conveyance Option: Alternative 8 Removed Habitat (Temporary)[c]	Conveyance Option: Difference from Alternative 1A
Tidal perennial aquatic[a]	86,263	41	-7	108	-25
Tidal brackish emergent wetland	8,501	0	0	0	0
Tidal freshwater emergent wetland	8,856	6	0	5	-1
Valley/foothill riparian	17,966	48	-10	25	-3
Nontidal perennial aquatic	5,567	12	0	9	0
Nontidal freshwater perennial emergent wetland	1,509	1	0	1	0
Alkali seasonal wetland complex	3,723	0	0	0	0
Vernal pool complex	12,133	3	0	0	0
Managed wetland	70,798	3	0	83	0
Other natural seasonal wetland	842	0	0	0	0
Grassland	78,047	305	-5	255	-7
Inland dune scrub	19	0	0	0	0
Cultivated land	487,106	3,741	-95	1,977	-214

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.

[b] Features in this category include the following conveyance-related facilities: Forebay, Afterbay, Intake Facilities, Pump Stations, Permanent Access Roads, Shaft Locations, and Reusable Tunnel Material Storage Areas.

[c] Features in this category include the following conveyance features: Barge Unloading Facility, Control Structure Work Area, Intake Road Work Area, Intake Work Area, Pipeline, Pipeline Work Area, Road Work Area, Safe Haven Work Area, Temporary Access Road Work Area, Tunnel Work Area, and Borrow/Spoil Areas.

5

Table 12-8-2 Alternative 8 Effects on Jurisdictional Wetlands and Waters Relative to Alternative 1A (acres)

	Alternative 8 Impacts on Jurisdictional Wetlands and Waters			
Wetland/Water Type	Permanent Impact	Difference from Alternative 1A	Temporary Impact	Difference from Alternative 1A
Agricultural Ditch	64.6	-0.3	21.9	-1.6
Alkaline Wetland	0.1	0	0	0
Clifton Court Forebay	1.0	0	0	0
Conveyance Channel	12.7	0	1.1	0
Depression	1.9	0	0.4	-1.3
Emergent Wetland	46.8	0	6.7	-0.6
Forest	5.6	-0.1	10.8	-1.1
Lake	0	0	0.3	0
Scrub-Shrub	20.3	-0.3	3.3	-1.0
Seasonal Wetland	18.7	0	26.6	0
Tidal Channel	36.9	-6.1	109.6	-24.2
Vernal Pool	0		0	0
Total	**209**	**-6.8**	**181**	**-29.8**

These differences in loss of habitat from constructing the water conveyance facilities would create differences in effects on covered and noncovered wildlife. The reduced level of valley/foothill riparian habitat loss would be a positive influence on valley elderberry longhorn beetle, breeding habitat for raptors, herons and egrets (great egret, snowy egret, great blue heron, Swainson's hawk, Cooper's hawk, white-tailed kite and black-crowned night heron), and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. Species that would benefit from smaller permanent losses of grassland and cultivated land would include foraging raptors (Swainson's hawk, short-eared owl, northern harrier, merlin and white-tailed kite), greater sandhill crane, mountain plover, California horned lark, tricolored blackbird and several species of bats. Alternative 8 would permanently remove 85 fewer acres of greater sandhill crane foraging habitat when compared to Alternative 1A The smaller temporary habitat conversions associated with Alternative 8 would have comparable benefits to these species.

The differences in effect that Alternatives 1A and 8 could have on special-status plant species are extremely minor. Habitat modeling indicates that Alternative 8 would cause 3 fewer acres of permanent and 2 fewer acres of temporary habitat loss for Mason's lilaeopsis and delta mudwort when compared with Alternative 1A.

The near-term conservation activities described in Appendix 12D, *Feasibility Assessment of Conservation Measures Offsetting Water Conveyance Facilities Construction Impacts on Terrestrial Biological Resources*, would provide for conservation, enhancement and replacement of habitats affected by the early water conveyance facility construction activities. This conservation activity, which is part of the early implementation of the BDCP, and the mitigation measures included in the Alternative 1A analysis would offset water conveyance facilities construction effects of Alternative 8 on both covered and noncovered special-status species in the study area.

Effects of Restoration-Related Actions of Alternative 8

Natural community changes associated with the other major restoration activities in Alternative 8 (CM2, CM4, and CM5— Table 12-8-3; CM7, CM8, CM10, and CM18—Table 12-8-4) would be identical to those described for Alternative 1A. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community restoration and protection conservation measures.

Table 12-8-3. Alternative 8 Late Long-Term Effects of Restoration Activities (CM2, CM4, CM5) that Affect Most Natural Communities (acres)

	Conservation Measure					
	CM2[b]		CM4[c]		CM5[d]	
Natural Community	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]	Permanent[e]	Temporary[f]
Tidal perennial aquatic[a]	8	11	18	0	2	5
Tidal brackish emergent wetland	0	0	1	0	0	0
Tidal freshwater emergent wetland	6	0	1	0	1	1
Valley/foothill riparian	89	88	552	0	43	35
Nontidal perennial aquatic	24	12	189	0	28	16
Nontidal freshwater perennial emergent wetland	25	1	99	0	0	0
Alkali seasonal wetland complex	45	0	27	0	0	0
Vernal pool complex	0	0	372	0	0	0
Managed wetland	24	44	13,746	0	0	0
Other natural seasonal wetland	0	0	0	0	0	0
Grassland	388	239	1,122	0	51	34
Inland dune scrub	0	0	0	0	0	0
Cultivated lands	540	1	34,653	0	2,087	1,194

[a] Tidal mudflat has been included in the tidal perennial aquatic natural community.
[b] Yolo Bypass Fisheries Enhancement.
[c] Tidal Natural Communities Restoration.
[d] Seasonally Inundated Floodplain Restoration.
[e] Features in this category include the following: construction of fish passage structures and infrastructure in the Yolo Bypass, construction of permanent structures and infrastructure associated with restoration, and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, and temporary grading/vegetation removal associated with restoration activities.

Table 12-8-4. Alternative 8 Late Long-Term Effects of Restoration Activities (CM7, CM8, CM10, CM18) that Affect Only Grassland and Cultivated Lands (acres)

Natural Community	Conservation Measure							
	CM7[a]		CM8[b]		CM10[c]		CM18[d]	
	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]	Perm[e]	Temp[f]
Grassland	410	0	0	0	0	0	35	0
Cultivated lands	4,553	0	2,000	0	1,950	0	0	0

[a] Riparian Natural Community Restoration.
[b] Grassland Natural Community Restoration.
[c] Nontidal Marsh Restoration.
[d] Conservation Hatcheries.
[e] Features in this category include the following: construction of permanent structures and infrastructure associated with restoration, recreation facilities and hatcheries; and loss of habitat associated with removal and replacement by other habitats.
[f] Features in this category include the following: temporary work areas associated with construction of permanent restoration features, recreation facilities and hatcheries; and temporary grading/vegetation removal associated with restoration activities.
Perm = Permanent
Temp = Temporary

The reader is referred to the Alternative 1A impact analysis earlier in this chapter for the broader discussion of overall terrestrial biological resources effects that would result from implementation of Alternative 8 restoration-related conservation actions. The principal effects of concern associated with both Alternative 1A and 8 are related to the conversion of large acreages of cultivated lands, managed wetland, grassland and valley/foothill riparian habitat to tidal marsh and other habitat types during restoration activities. These effects accrue to special-status species and common wildlife species, especially to those that rely on cultivated lands and managed wetland during some life stage. Foraging raptors and some waterbirds are regular inhabitants of the Delta's cultivated lands. The Delta's managed wetlands provide freshwater nesting, feeding and resting habitat for a large number of Pacific flyway waterfowl and shorebirds, as well as nesting passerines, such as tricolored blackbird. Special-status plant species that occupy the tidal fringe in Suisun Marsh and parts of the Delta would be subject to losses associated with physical construction activity (levee breaching and reconstruction) and changes in water depth and salinity in their current habitat as a result of tidal marsh restoration.

Some of the permanent habitat loss associated with the restoration components of Alternative 8 would occur during the early, construction-related stage of the BDCP. Other losses would occur over time as some habitats (cultivated lands, managed wetland, valley/foothill riparian and grassland) are converted to tidal marsh (tidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland) and other natural communities. The BDCP conservation components, including the restoration components (CM2–CM10), are designed to eventually replace and expand habitats that would have a positive influence on plant and animal species covered in the Plan, including those that rely on managed wetland and cultivated land. These conservation components would also have a positive effect on noncovered and common species that occupy the study area.

NEPA Effects: Alternative 8 would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered and noncovered species. Where conservation actions would not fully offset effects, the Plan has developed AMMs and this document has included additional mitigation measures to avoid adverse effects. Alternative 8 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

CEQA Conclusion: Alternative 8 would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. The alternative also would not disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 1A, there would be large acreages of existing habitat converted by the Plan's conservation actions, including the construction of water conveyance tunnels from the north Delta to Clifton Court Forebay in the south Delta. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (CM2–CM10) would permanently replace primarily cultivated land and managed wetland with tidal and nontidal marsh, riparian vegetation, and grassland. The increases in acreage and value of the sensitive natural communities in the study area would have beneficial effects on covered, noncovered, and common species. Where conservation actions would not fully offset impacts, the Plan has developed AMMs and this document has included additional mitigation measures to avoid significant impacts. Alternative 8 would not require mitigation measures beyond what is proposed for Alternative 1A to offset effects.

As with Alternative 1A, Alternative 8 would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the impact offsets provided by Alternative 8 AMMs and CM2–CM21 conservation actions. The relevant mitigation measures, which are included in detail in the analysis of Alternative 1A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-69a: Compensate for the Loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat

- Mitigation Measure BIO-72: Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat
- Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Feruginous Hawk Foraging Habitat
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat
- Mitigation Measure BIO-129a: Compensate for Loss of Black Tern Nesting Habitat
- Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat
- Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States
- Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh
- Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins
- Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

12.3.3.16 Alternative 9—Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G)

Section 3.5.16 of Chapter 3, *Description of Alternatives*, describes Alternative 9 in detail, and Figure 3-16 depicts the alternative.

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal or modification of this community (see Table 12-9-1). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the tidal perennial aquatic natural community (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

There is a variety of other, less specific conservation goals and objectives that would improve the value of tidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to AMMs, impacts on tidal aquatic natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Note that two time periods are represented in Table 12-9-1 and the other tables contained in the analysis of Alternative 9. The near-term (NT) acreage effects listed in the table would occur over the first 10 years of Plan implementation. The late long-term (LLT) effects contained in these tables represent the cumulative effects of all activities over the entire 50-year term of the Plan. This table and all impact tables in the chapter include reference to only those CMs that would eliminate natural community acreage either through construction or restoration activities, or would result in periodic inundation of the community. Table 3-4 in Chapter 3, *Description of Alternatives*, describes the schedule for implementation of natural community protection and restoration conservation measures.

Table 12-9-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	675	675	345	345	0	0
CM2	8	8	11	11	9–36	0
CM4	11	18	0	0	0	0
CM5		2	0	5	0	39
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**694**	**703**	**356**	**361**	**9–36**	**39**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, channel dredging and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently affect an estimated 703 acres and temporarily remove 361 acres of tidal perennial aquatic natural community in the study area. These modifications would affect approximately 1% of the 86,263 acres of the community that is mapped in the study area. The majority of the permanent and temporary effects would occur during the first 10 years of Alternative 9 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 8,300 acres of tidal wetlands, including an estimated 3,400 acres of tidal perennial aquatic natural community during the same period, which would expand the area of that habitat and offset the losses. The 3,400-acre increase is estimated, based on modeling reported in BDCP Appendix 3.B, Table 5, by comparing existing Plan Area subtidal habitat to near-term subtidal habitat with the Plan. The BDCP beneficial effects analysis for Alternative 4 (BDCP Chapter 5, Section 5.4.1.2) indicates that, while there would be no minimum restoration requirement for the tidal perennial aquatic natural community, an estimated approximately 27,000 acres of tidal perennial aquatic natural community would be restored based on tidal restoration modeling. This estimate is based on Table 5 in BDCP Appendix 3.B, subtracting late long-term without project acreage from late long-term with project acreage. The same conservation actions would be implemented for Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of in-water features and dredging of existing Delta waterways as part of Alternative 9's water conveyance facilities would permanently remove 675 acres and temporarily remove 345 acres of tidal perennial aquatic community. The permanent effects would occur at channel dredging sites, operable barrier construction sites and channel widening sites throughout the study area. These construction and dredging activities would not permanently remove the waterways, but would permanently modify the channel bottoms and eliminate any associated aquatic vegetation. The affected areas and type of activity are listed below (refer to the Terrestrial Biology Mapbook for details of these locations).
  - Dredging for channel enlargement in Victoria Canal from Middle River to Old River.
  - Dredging for channel enlargement in Middle River from Victoria Canal to Mildred Island.
  - Canal construction in Old River south of Grant Line Canal.
  - Canal construction across Old River and West Canal at Coney Island.
  - Operable barrier construction in San Joaquin River just north of junction with Old River, near Lathrop.
  - Operable barrier construction in Middle River just south of Victoria Canal.
  - Operable barrier construction in Victoria Canal at its junction with Old River.
  - Operable barrier construction in North Victoria Canal/Woodward Canal just west of Middle River.
  - Operable barrier construction in Railroad Cut at the south end of Bacon Island.
  - Operable barrier construction in Connection Slough just west of Middle River.
  - Operable barrier construction at the west end of Three Mile Slough at its junction with the Sacramento River.
  - Operable barrier construction at the north end of Fishermans Cut at its junction with the San Joaquin River.
  - Operable barrier construction in Old River at its junction with the San Joaquin River north of Franks Tract.
  - Operable barrier construction at the north end of Georgianna Slough at the Sacramento River.
  - Operable barrier construction at the west end of Delta Cross Channel at the Sacramento River.
  - Operable barrier construction in Snodgrass Slough just north of its junction with Delta Cross Channel.
  - Channel enlargement and operable barrier construction in Mokelumne River at Lost Slough.
  - Channel enlargement and connection in the Meadows Slough at its junction with the Sacramento River.
  - Channel enlargement and connection within the Meadows Slough east of the Sacramento River.
  - Fish screen construction in the Sacramento River at Georgianna Slough and Delta Cross Channel.

The temporary effects to tidal perennial aquatic natural community would occur primarily along the channels of the Middle River and Victoria Canal, where temporary work areas would be needed to support channel dredging operations described above. Several smaller temporary impact areas would occur where barge operations areas would be developed at these sites.

- o North Victoria Canal at Middle River.
- o Railroad Cut at Middle River at south end of Bacon Island.
- o Middle River at southeastern edge of Bacon Island.
- o Middle River at Upper Jones Tract,
- o Fishermans Cut at its junction with the San Joaquin River.
- o Old River at the San Joaquin River north of Franks Tract.

All of these temporary and permanent effects on tidal perennial aquatic natural community from CM1 would occur during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 8 acres could be permanently lost and another 11 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.

CM4 Tidal Natural Communities Restoration: Based on the use of hypothetical restoration footprints, implementation of CM4 would affect 18 acres of tidal perennial aquatic community. CM4 involves conversion of existing natural communities to a variety of tidal wetlands, including tidal perennial aquatic, tidal brackish emergent, and tidal freshwater emergent wetlands. Specific locations for these conversions are not known. The 18 acres could remain tidal perennial aquatic with a modified tidal prism, or they could eventually be converted to one of the other tidal wetland types. For purposes of this analysis, a conservative approach has been taken and the effect has been discussed simultaneously with the habitat losses associated with other conservation measures. An estimated 65,000 acres of tidal wetlands and transitional uplands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic habitat would be restored, based on modeling conducted by ESA PWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration would be consistent with BDCP Objective TPANC1.1. Approximately 3,400 acres of the restoration would occur during the first 10 years of Alternative 9 implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal natural communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 2 acres and temporarily remove 5 acres of tidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the tidal perennial aquatic habitats directly affected. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on tidal perennial aquatic habitat. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the tidal perennial aquatic community through CM1 construction losses (675 acres permanent and 345 acres temporary) and the CM2 construction losses (8 acres permanent and 11 acres temporary). These losses would occur at channel dredging sites along Middle River and Victoria Canal, at channel widening and operable barrier construction sites at multiple locations in the study area, and in the northern Yolo Bypass. Approximately 11 acres of the inundation and construction-related effects resulting from CM4 would occur during the near-term throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 9 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 1,050 acres of restoration would be needed to offset (i.e., mitigate) the 1,050 acres of effect (a combination of the permanent and temporary near-term effects listed in Table 12-9-1) associated with near-term activities, including water conveyance facilities construction.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in BDCP Appendix 3.C.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in relatively minor (approximately 1%) conversions or losses of tidal perennial aquatic community in the study area. These losses or conversions (703 acres of permanent and 361 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation conversions would occur during the course of BDCP restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, approximately 27,000 acres of high-value tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*).

NEPA Effects: The creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community as part of CM4 during the first 10 years of Alternative 9 implementation would offset near-term losses associated with construction activities for CM1, CM2, CM4, and CM6, avoiding any adverse effect. Alternative 9, which includes restoration of an estimated 27,000 acres of this natural community over the course of the Plan, would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the near-term loss or conversion of approximately 1,050 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The losses would occur primarily along the Middle River and Victoria Canal as these channels are dredged to improve capacity, but would also occur at numerous channel widening, barge unloading and operable barrier construction sites throughout the Delta. Losses would also occur within the northern section of the Yolo Bypass. Inundation conversions would occur at various tidal restoration sites throughout the study area. The losses and conversions would be spread across a 10-year near-term timeframe. These losses and conversions would be offset by planned restoration of 3,400 acres of high-value tidal perennial aquatic natural community scheduled for the first 10 years of Alternative 9 implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 1,050 acres of restoration would be needed to offset (i.e., mitigate) the 1,050 acres of loss or conversion. The restoration would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 1,064 acres of the tidal perennial aquatic natural community would be lost or converted and an estimated 27,000 acres of this community would be restored. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 9 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Two Alternative 9 conservation measures would modify the water depths and inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation and changes in water depth and velocity of 9–36 acres of tidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 9-acre increase in inundation would be associated with a notch flow of 1,000 cfs, and the 36-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of the tidal perennial aquatic community occurs in the southern section of the bypass on Liberty Island, and, to a lesser extent, along the eastern edge of the bypass, including the Tule Canal/Toe Drain. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would be expected to be beneficial to the ecological function of tidal perennial aquatic habitat in the bypass as it relates to BDCP covered aquatic species. The Yolo Bypass waterway is the key element in the Yolo Bypass landscape linkage mapped in Figure 12-2 and described in detail in BDCP Chapter 3, Table 3.2-3. The change in periodic inundation in the bypass would not substantially modify its value for special-status or common terrestrial species. Water depths and water flow rates would increase over Existing Conditions and the No Action condition in approximately 30% of the years, but it would not fragment the habitat or make it less accessible to special-status or common terrestrial species. The modifications would not result in a loss of this community. The plant species associated with this community are adapted to inundation. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of these changes in the inundation regime on terrestrial species that rely on tidal perennial aquatic habitats are discussed in detail later in this chapter, under the individual species assessments.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of flooding of 39 acres of tidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The more frequent exposure of these wetlands to stream flooding events would be beneficial to the ecological function of tidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The plant species associated with these tidal perennial aquatic areas are adapted to inundation and would not be substantially modified.

In summary, 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5). Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area; therefore, periodic changes in water depth and velocity would not result in a net permanent reduction in the acreage of this community in the study area.

NEPA Effects: Increasing periodic inundation of tidal perennial aquatic natural community would not have an adverse effect on the community.

CEQA Conclusion: An estimated 48–75 acres of tidal perennial aquatic community in the study area would be subjected to more frequent increases in water depth and velocity from inundation as a result of implementing CM2 and CM5 under Alternative 9. Tidal perennial aquatic community is already, by definition, permanently inundated aquatic habitat of value to terrestrial and aquatic species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at two newly screened sites at Georgianna Slough and Delta Cross Channel in the north Delta, the operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, modified diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Flow volumes in these two diversions and in the downstream channels that had been dredged (Middle River and Victoria Canal) would increase under certain Sacramento River flow conditions and water year types. However, tidal influence in the Sacramento River and Delta waterways would continue to be dominant such that there would be no significant change in water levels that might affect in-stream and adjacent vegetation. Modified diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal

perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites. Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control*, and is consistent with BDCP Objective TRANPC2.1. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging*. Long-term operation of the Alternative 9 diversions on the Sacramento River (Georgianna Slough and Delta Cross Channel) would include periodic dredging of sediments that might accumulate in front of intake and fish screens. Maintenance dredging would also be required in Middle River and Victoria Canal to maintain channel capacity. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed later in this chapter. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on tidal perennial aquatic habitats.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic flooding of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the tidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect to the community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 9 would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage and value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Brackish Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no adverse effect on the habitats associated with the tidal brackish emergent wetland natural community. Habitat restoration and construction associated with CM1, CM2, CM5, and CM6 would not remove tidal brackish emergent wetland; levee breaching and minor construction associated with CM4 may temporarily remove small amounts of this natural community (see Table 12-9-2). Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit the tidal brackish emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the restored and protected tidal natural communities and transitional uplands, restore or create at least 6,000 acres of tidal brackish emergent wetland in Conservation Zone 11 (Objective TBEWNC1.1 associated with CM4).
- Restore connectivity to isolated patches of tidal brackish emergent marsh where isolation has reduced effective use of these marshes by the species that depend on them (Objective TBEWNC1.3 associated with CM4).
- Create topographic heterogeneity in restored tidal brackish emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TBEWNC1.4 associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1 associated with CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal brackish emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-2. Changes in Tidal Brackish Emergent Wetland Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	Unk.	Unk.	Unk.	Unk.	0	0
CM5	0	0	0	0	0	0
CM6	0	0	0	0	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction of the Alternative 9 water conveyance facilities (CM1) would not affect tidal brackish emergent wetland natural community.

Restoration of tidal marsh habitats associated with CM4 would require site preparation, earthwork, and other site activities that could remove tidal brackish emergent wetland. Levee modifications, grading or contouring, filling to compensate for land subsidence, and creation of new channels could also result in the removal of tidal brackish emergent wetland. All of this construction and land modification activity that could affect tidal brackish emergent wetland would occur in Suisun Marsh (CZ 11). The acreage of loss has not been calculated because the specific locations for site preparation and earthwork have not been identified, but the loss would likely be very small (less than 1 acre). These activities would occur through the course of the CM4 restoration program. The restoration elements of CM4 would greatly exceed any of the short-term losses described above. At least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area (BDCP Objective TBEWNC1.1, associated with CM4), with 2,000 acres of restoration occurring in the near-term timeframe. In addition, the habitat and ecosystem functions of BDCP restored tidal brackish emergent wetland would be maintained and enhanced (CM11). The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.3.2) states that at least 6,000 acres of tidal brackish emergent wetland community would be restored in CZ 11, and that tidal natural communities restoration would decrease habitat fragmentation by providing additional connectivity between isolated patches of tidal brackish emergent wetland. These same conservation actions would be implemented under Alternative 9.

The restoration activities associated with CM4 in Suisun Marsh would result in other effects that could alter the habitat value of tidal brackish emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Tidal flooding of dry areas could also increase the bioavailability of methylmercury in Suisun Marsh. Site-specific conditions would dictate the significance of this hazard to tidal brackish marsh vegetation and associated wildlife. According to the Suisun Marsh Plan EIR/EIS (Bureau of Reclamation et al. 2010, pg. 5.2-18), marsh creation may generate less methylmercury than is currently being generated by managed wetlands. However, this has not been confirmed through comprehensive studies. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh and the potential for increased nitrogen deposition associated with construction vehicles are also issues of concern that are difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal brackish emergent wetland in the study area.

NEPA Effects: The increase of tidal brackish emergent wetland associated with CM4 would be a beneficial effect on the natural community.

CEQA Conclusion: Tidal brackish emergent wetland natural community could experience small losses in acreage in Suisun Marsh (CZ 11) as a result of the large-scale tidal marsh restoration planned as part of CM4. These losses (expected to not exceed 1 acre) would be associated with levee modification, site preparation and other earthwork needed to expose diked lands to tidal influence. Because at least 6,000 acres of tidal brackish emergent wetland would be restored in the Plan Area as part of CM4, including 2,000 acres restored in the near-term timeframe, there would be a large increase in tidal brackish emergent wetland both in the near-term and over the life of the Plan. Indirect effects associated with the expansion of tidal brackish emergent wetland natural community, including the potential spread of invasive species, the generation of methylmercury, increases in marsh water temperatures, and increased nitrogen deposition are not expected to have a significant impact on this natural community in the study area. Therefore, this impact would be beneficial.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at two newly screened sites at Georgianna Slough and Delta Cross Channel in the north Delta, the operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging at the two diversions with fish screens and in the Middle River and Victoria Canal, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of the tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not affect tidal brackish emergent wetland because this community does not exist along upstream rivers. Modified diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in tidal brackish emergent wetland community downstream of these diversions. Flow volumes in these two diversions and in the downstream channels that had been dredged (Middle River and Victoria Canal) would increase under certain Sacramento River flow conditions and water year types. However, tidal influence in the Sacramento River and Delta waterways would continue to be dominant such that there would be no substantial change in water levels that might affect in-stream and adjacent vegetation. Modified diversions from south Delta channels would not create a reduction in this natural community.

- *Access road and levee repair*. Periodic repair of access roads and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of restoration sites (*CM11 Natural Communities Enhancement and Management)*. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

- *Channel dredging*. Long-term maintenance of tidal channels that support wetland expansion in Suisun Marsh would include periodic dredging of sediments. The dredging would occur adjacent to tidal brackish emergent wetland natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value in the short term for special-status and common species that rely on it for cover, movement corridor or foraging area. The individual species effects are discussed later in this chapter. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on adjacent sensitive vegetation.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, channel dredging and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the tidal brackish emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes (not exceeding 1 acre) in total acreage of tidal brackish emergent wetland natural community in Suisun Marsh, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (Table 12-9-3). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the tidal freshwater emergent wetland natural community.

- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3 associated with CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands, include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM4).
- Within the 65,000 acres of tidal natural communities, restore or create at least 24,000 acres of tidal freshwater emergent wetland in Conservation Zones 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Restore tidal freshwater emergent wetlands in areas that increase connectivity among conservation lands (Objective TFEWNC1.2, associated with CM4).
- Restore and sustain a diversity of marsh vegetation that reflects historical species compositions and high structural complexity (Objective TFEWNC2.1, associated with CM4).
- Create topographic heterogeneity in restored tidal freshwater emergent wetland to provide variation in inundation characteristics and vegetative composition (Objective TFEWNC2.2, associated with CM4).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of tidal freshwater emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-3. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	62	62	123	123		
CM2	6	6	0	0	24–58	
CM4	1	1	0	0		
CM5	0	1	0	1		3
CM6	Unk.	Unk.	Unk.	Unk.		
TOTAL IMPACTS	**69**	**70**	**123**	**124**	**24–58**	**3**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 70 acres and temporarily remove 124 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent approximately 2% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would occur during the first 10 years of Alternative 9 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add at least 24,000 acres of tidal freshwater emergent wetland natural community during the course of Plan restoration activities, which would greatly expand the area of this natural community and offset the losses. The BDCP beneficial effects evaluation of Alternative 4 (BDCP Chapter 5, Section 5.4.4.2) states that the implementation of *CM4 Tidal Natural Communities Restoration* will restore at least 24,000 acres of tidal freshwater emergent wetland community in Cache Slough (Conservation Zones 1, 2, and 3), the Cosumnes/Mokelumne (Conservation Zone 4), West Delta (Conservation Zone 5 and 6), and South Delta (Conservation Zone 7) ROAs. The BDCP evaluation also states that the objectives in the Plan will promote vegetation diversity and structural complexity (as incorporated into the restoration design) in restored tidal freshwater marsh. These same conservation actions would be implemented under Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would permanently remove 62 acres and temporarily remove 123 acres of tidal freshwater emergent wetland community. Most of the permanent loss would occur at the channel dredging sites within the Middle River and Victoria Canal. Middle River dredging would occur from Victoria Canal north to Mildred Island, while Victoria Canal dredging would extend from Middle River westward to Old River. This community exists as fringing vegetation along the banks of these channels and also as fringing vegetation on the islands within the channels. Smaller areas would be permanently lost at operable barrier sites adjacent to Middle River and San Joaquin River. Temporary tidal freshwater emergent wetland removal would occur at dredging work areas along Victoria Canal and Middle River. Detailed mapping of these facilities in relation to natural communities can be found in the Terrestrial Biology Mapbook. These losses would take place during the near-term construction period.

  There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of CM1. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities,* addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction or channel modification activities within the Yolo and Sacramento Bypasses, including improvements in flow through the west side channel of the bypass, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in tidal freshwater emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 6 acres could be permanently lost to these activities. The loss is expected to occur in the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Based on hypothetical footprints of this restoration activity, initial land grading and levee modification could permanently remove 1 acre of tidal freshwater emergent wetland natural community. This loss would occur in the near-term timeframe and would occur throughout the ROAs identified for tidal wetland restoration. At the same time, an estimated 24,000 acres of tidal freshwater emergent wetland community would be restored during tidal habitat restoration, consistent with BDCP Objective TFEWNC1.1, associated with CM4. Approximately 8,850 acres of the restoration would occur during the first 10 years of Alternative 9 implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Tidal wetland communities restoration is expected to be focused in the ROAs identified in Figure 12-1. Restoration would be located and designed to improve habitat connectivity (Objective TFEWNC1.2), improve marsh species diversity (Objective TFEWNC2.1), and provide variation in inundation characteristics (Objective TFEWNC2.2). Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.

  The restoration activities associated with CM4 in the Plan Area ROAs would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of CM11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal freshwater marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough, Cosumnes/Mokelumne and Suisun Marsh ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. Because of the difficulty in assessing this risk at a programmatic level, it will need to be considered at a project level. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh.

Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 1 acre and temporarily remove 1 acre of tidal freshwater emergent wetland habitat. The construction-related losses would be considered a permanent removal of the habitats directly affected. The majority of seasonally inundated floodplain restoration is expected to occur along the lower San Joaquin River in the south and central Delta areas. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Floodplain restoration along the San Joaquin River would improve connectivity for a variety of species that rely on freshwater marsh and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River are included in Figure 12-2.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on narrow strips of habitat, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the tidal freshwater emergent wetland natural community through CM1 construction losses (62 acres permanent and 123 acres temporary), CM2 construction losses (6 acres permanent), and CM4 construction losses (1 acre permanent). These losses would occur primarily in the southern and central Delta along Middle River and Victoria Canal, north and east of Clifton Court Forebay. Smaller areas would be lost at operable barrier sites along Middle River and San Joaquin River in the central Delta, and at various locations within the Yolo Bypass and the tidal restoration ROAs.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 9 implementation would more than offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 192 acres of restoration would be needed to offset (i.e., mitigate) the 192 acres of loss (the total permanent and temporary near-term effects listed in Table 12-9-3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in relatively minor (approximately 2%) losses of tidal freshwater emergent wetland community in the study area. These losses (70 acres of permanent and 124 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and levee modification and land grading associated with tidal marsh restoration (CM4) and floodplain restoration (CM5). The CM4 and CM5 losses would occur during the course of the CM4 and CM5 conservation actions at various tidal and floodplain restoration sites throughout the study area. By the end of the Plan timeframe, a total of 24,000 acres of this natural community would be restored. The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Slough, South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).

NEPA Effects: The creation of 8,850 acres of tidal freshwater emergent wetland natural community as part of CM4 during the first 10 years of Alternative 9 implementation would more than offset the construction and inundation-related effects of implementing CM1, CM2, CM4 and CM5, avoiding any adverse effect in the near-term. Because of the 24,000 acres of tidal freshwater emergent wetland restoration that would occur over the course of the Plan, Alternative 9 would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the loss of approximately 192 acres of tidal freshwater emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and tidal marsh restoration (CM4) in the near-term. The construction losses would occur primarily in the southern and central Delta along Middle River and Victoria Canal, north and east of Clifton Court Forebay. Smaller areas would be lost at operable barrier sites along Middle River and San Joaquin River in the central Delta, and at various locations within the Yolo Bypass and the tidal restoration ROAs. The losses would be spread across a 10-year near-term timeframe and would be offset by planned restoration of 8,850 acres of tidal freshwater emergent wetland natural community scheduled for the first 10 years of Alternative 9 implementation (CM4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 192 acres of restoration would be needed to offset (i.e., mitigate) the 192 acres of loss. The restoration would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 194 acres of this community would be lost to conservation activities and 24,000 acres of this community would be restored. There would be no net permanent reduction in the acreage and value of this sensitive natural community within the study area. Therefore, Alternative 9 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of tidal freshwater emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation of 24–58 acres of tidal freshwater emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently inundated would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 24-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 58-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Most of this community occurs in the southern section of the bypass on Liberty Island, on the fringes of tidal perennial aquatic habitats. Smaller areas are scattered among the cropland within the bypass, south of Interstate 80. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of tidal freshwater emergent wetland habitats and would not substantially modify its value for special-status or common terrestrial species. The plants in this natural community are adapted to periodic inundation events within the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in a seasonal increase in the frequency and duration of inundation of 3 acres of tidal freshwater emergent wetland habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to their ecological function, especially as they relate to BDCP target terrestrial and

aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5). Tidal freshwater emergent wetland natural community is a habitat of great value to both terrestrial and aquatic species in the study area.

NEPA Effects: Periodic inundation of tidal freshwater emergent wetland natural community associated with Alternative 9 would not result in a net permanent reduction in the acreage and value of this community in the study area. There would be no adverse effect.

CEQA Conclusion: An estimated 27–61 acres of tidal freshwater emergent wetland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. This community is of great value to aquatic and terrestrial species in the study area. The periodic inundation would not result in a net permanent reduction in the acreage and value of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at two newly screened sites at Georgianna Slough and Delta Cross Channel in the north Delta, the operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging at the two diversions with fish screens and in the Middle River and Victoria Canal, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal freshwater emergent wetland community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, modified diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in tidal freshwater emergent wetland community downstream of these diversions. Flow volumes in these two diversions and in the downstream channels that had been dredged (Middle River and Victoria Canal) would increase under certain Sacramento River flow conditions and water year types. However, tidal influence in the Sacramento River and Delta waterways would continue to be dominant such that there would be no substantial change in water levels that might affect in-stream and adjacent vegetation. Modified diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging*. Long-term operation of the Alternative 9 diversions on the Sacramento River (Georgianna Slough and Delta Cross Channel) would include periodic dredging of sediments that might accumulate in front of intake and fish screens. Maintenance dredging would also be required in Middle River and Victoria Canal to maintain channel capacity. The dredging would occur in the vicinity of tidal freshwater emergent natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for nesting habitat, cover or foraging area. The individual species effects are discussed later in this chapter. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on tidal freshwater emergent wetland habitats.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns, channel and levee maintenance, and vegetation control. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have a near-term adverse effect on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of CM1, CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-9-4). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the valley/foothill riparian natural community.

- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5 and CM7).
- Maintain 500 acres of mature riparian forest in Conservation Zones 4 or 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to late-successional riparian vegetation (VFRNC2.2), in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).
- Maintain or increase abundance and distribution of valley/foothill riparian natural community vegetation alliances that are rare or uncommon as recognized by California Department of Fish and Game (2010), such as button willow thickets alliance and blue elderberry stands alliance (Objective VFRNC3.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of valley/foothill riparian natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs and mitigation, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-4. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	61	61	248	248	0	0
CM2	89	89	88	88	51–92	0
CM4	298	552	0	0	0	0
CM5	0	43	0	35	0	266
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**448**	**745**	**336**	**371**	**51–92**	**266**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, channel dredging, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 745 acres and temporarily remove 371 acres of valley/foothill riparian natural community in the study area. These modifications represent approximately 6% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would occur during the first 10 years of Alternative 9 implementation, as Delta channels are dredged, new diversion structures and operable barriers are constructed, and habitat restoration is initiated. Valley/foothill riparian protection (750 acres) and restoration (800 acres) would be initiated during the same period, which would partially offset the losses. By the end of the Plan period, 5,000 acres of this natural community would be restored. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.5.2) indicates that implementation of Alternative 4 would restore or create 5,000 acres of riparian forest and scrub in Conservation Zones 1, 2, 4, 5, 6, and 7, with at least 3,000 acres occurring on restored seasonally inundated floodplain. Alternative 4 would also protect 750 acres of existing valley/foothill riparian natural community in Conservation Zone 7. These same conservation measures would be implemented under Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would permanently remove 61 acres and temporarily remove 248 acres of valley/foothill riparian natural community. Most of the permanent loss would occur as wider and deeper channels are dredged in Middle River and Victoria Canal, and as operable barriers and new Sacramento River diversions are constructed in various waterways across the Delta. Much of the riparian vegetation in this area is composed of dense stands of willows, brambles and blackberry, and associated low profile woody plants. The principal facilities that would cause permanent losses and the general types of riparian vegetation that would be lost are listed below.
  - Victoria Canal dredging: small island patches of riparian dominated by California dogwood.
  - Middle River dredging: large and small patches of riparian on in-channel islands dominated by California dogwood, willow, mixed brambles, tules and bulrush.
  - Canal construction across Old River near Clifton Court Forebay–small patches of riparian on the river margins dominated by blackberry, willow and giant reed;
  - Diversion structures and operable barriers on Sacramento River at Georgianna Slough and Delta Cross Channel: corridors of mixed riparian including valley oak, white alder, willow, mixed brambles and deciduous shrublands.
  - Channel enlargement at the Sacramento River and Meadows Slough: narrow band of riparian dominated by valley oak along the Sacramento River and larger stands of valley oak and willow along Meadows Slough.
  - Operable barrier construction at Mokelumne River and Lost Slough: narrow bands of willow and walnut along the Mokelumne River and larger patches of mixed riparian including walnut, willow, mixed bramble, and white alder along Lost Slough.
  - Operable barrier construction at the San Joaquin River and Fishermans Cut: small patches of willow and mixed brambles.
  - Operable barrier construction on the San Joaquin River at the head of Old River: small stringers and patches of cottonwood, willow and valley oak along the San Joaquin River.

  Temporary losses of riparian community would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. Some of this vegetation may be temporarily removed as dredging progresses, while other areas may remain in place but be temporarily affected by sedimentation and equipment movement associated with dredging. The riparian vegetation in this area is also composed primarily of dense stands of willows, brambles and blackberry, and associated low profile woody plants. Refer to the Terrestrial Biology Mapbook for a more detailed view of these impact areas. These losses would take place during the near-term construction period.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 would involve a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 89 acres could be permanently lost and another 88 acres could be temporarily removed. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. This vegetation is a mix of valley oak, sycamore, cottonwood and willow trees. The riparian areas here are primarily small, disconnected patches with moderate to low value as wildlife movement corridors. Most of these patches lack structural complexity. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would remove similar vegetation. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 552 acres of valley/foothill riparian community. The losses would be spread among most of the ROAs established for tidal restoration (see Figure 12-1). No losses would occur from Suisun Marsh restoration. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (BDCP Chapter 5, Section 5.4.5). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted by use of the theoretical footprint. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 43 acres and temporarily remove 35 acres of valley/foothill riparian natural community. The construction-related losses would be considered a permanent removal of the habitats directly affected. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM7 Riparian Natural Community Restoration*: The valley/foothill riparian natural community would be restored primarily in association with the tidal (CM4) and floodplain (CM5) restoration and channel margin enhancements (CM6). Following community-specific goals and objectives in the Plan, a total of 5,000 acres of this community would be restored (BDCP Objective VFRNC1.1) and 750 acres would be protected (BDCP Objective VFRNC1.2) over the life of the Plan. Approximately 800 acres would be restored and the entire 750 acres would be protected in the first 10 years of Plan implementation. Riparian restoration and protection would be focused in CZs 4 and 7 (BDCP Objective VFRNC2.3), with a goal of adding a 500-acre portion of the restoration in one or the other of these zones. A variety of successional stages would also be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area (BDCP Objective VFRNC2.4).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the valley/foothill riparian natural community through CM1 construction losses (61 acres permanent and 248 acres temporary) and the CM2 construction losses (89 acres permanent and 88 acres temporary). These losses would occur primarily along Middle River as channel dredging proceeds, at various operable barrier and diversion structure construction sites scattered across the Delta, and in the northern Yolo Bypass. Approximately 298 acres of the inundation and construction-related loss from CM4 would occur in the near-term. These losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with BDCP conservation components. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined in Section 404 of the CWA. As indicated above, much of this riparian loss would be in small patches or narrow strips along waterways, with limited structural complexity. The restoration of 800 acres (CM3) and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community (CM7) during the first 10 years of Alternative 9 implementation would partially offset this near-term loss. At least 400 acres of the protection is planned for the first 5 years of Alternative 9 implementation. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 784 acres of protection and 784 acres of restoration would be needed to offset (i.e., mitigate) the 784 acres of near-term loss (the combination of permanent and temporary near-term losses listed in Table 12-9-4). The combined 1,550 acres of protection and restoration in the near-term, combined with Plan goals for protecting and restoring high-value riparian habitats, are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration and protection acreages contained in the BDCP would not be sufficient to provide the typical level of mitigation for this community; therefore, the effect of Alternative 9 would be adverse. Mitigation would be available to offset this effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in an estimated 6% loss of valley/foothill riparian community in the study area. These losses (745 acres of permanent and 371 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), and inundation during tidal marsh restoration (CM4). Inundation losses would occur during the course of BDCP restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 5,000 acres of this natural community would be restored and 750 acres would be protected (CM7 and CM3, respectively). The restoration would occur primarily in CZs 4 and 7, in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

NEPA Effects: The restoration of 800 acres and protection (including significant enhancement) of 750 acres of valley/foothill riparian natural community as part of CM7 and CM3 during the first 10 years of Alternative 9 implementation would minimize the near-term loss of this community, but would result in an adverse effect. Because of the Plan's commitment to restoration of 5,000 acres and protection of 750 acres of valley/foothill riparian natural community during the course of the Plan, Alternative 9 would not result in a net long-term reduction in the acreage and value of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the loss of approximately 784 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4) in the near-term. These losses would occur primarily along Middle River as channel dredging proceeds, at various operable barrier and diversion structure construction sites scattered across the Delta, and in the northern Yolo Bypass. The construction losses would be spread across a 10-year near-term timeframe. These losses would be partially offset by planned restoration of 800 acres (CM7) and protection (including significant enhancement) of 750 acres (CM3) of valley/foothill riparian natural community scheduled for the first 10 years of Alternative 9 implementation. At least 400 acres of the protection is planned for the first 5 years of Alternative 9 implementation. Implementation of Plan goals for the location, patch size and composition of riparian community protection and restoration would aid in maintaining the value of riparian habitats in this near-term period. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts. In spite of these near-term restoration and protection activities and AMMs, impacts would be significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 784 acres of protection and 784 acres of restoration would be needed to offset (i.e., mitigate) the 784 acres of loss (the combination of permanent and temporary near-term losses listed in Table 12-9-4). Alternative 9 would be short 34 acres of protection in the near-term to meet typical mitigation ratios. The restoration would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species. With the implementation of Mitigation Measure BIO-9a, *Compensate for Loss of Valley/Foothill Riparian Natural Community*, the impact would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 1,116 acres of valley/foothill riparian natural community would be permanently or temporarily removed by conservation actions, 5,000 acres would be restored and 750 acres would be protected. There would be no net permanent reduction in the acreage and value of this sensitive natural community within the study area. Therefore, Alternative 9 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Mitigation Measure BIO-9a: Compensate for Loss of Valley/Foothill Riparian Natural Community

To fully compensate for loss of valley/foothill riparian natural community as a result of implementing Alternative 9, DWR shall increase its near-term goals for protection of this natural community to 784 acres.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of valley/foothill riparian natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement:* Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation of 51–92 acres of valley/foothill riparian natural community. The area more frequently inundated would vary with the flows that would be passed through the newly constructed notch in the Fremont Weir. The 51 acres would be created by a notch flow of 8,000 cfs and the 92 acres would be created by a notch flow of 4,000 cfs. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. These increased flow conditions would be expected to occur in no more than 30% of all years (see BDCP Chapter 5, Section 5.4.1.2). The valley/foothill riparian community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass. There are other riparian habitat areas on Liberty Island, and, to a lesser extent, along the eastern and western edges of the bypass, including along the Tule Canal/Toe Drain, the west side channels and the Sacramento Bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect riparian habitats, as they have persisted under similar high flows and extended inundation periods in the Yolo Bypass. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 266 acres of valley/foothill riparian habitats. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The reconnection of riparian vegetation to periodic stream flooding events would be beneficial to the ecological function of this natural community, especially in the germination and establishment of native riparian plants as flood scour increases.

In summary, 317–368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5). The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. The increased inundation could create a beneficial effect on the community as it relates to germination and establishment of native riparian plants.

NEPA Effects: Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial effect on the community.

CEQA Conclusion: An estimated 317–368 acres of valley/foothill riparian community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. The valley/foothill riparian community is conditioned to and benefits from periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of valley/foothill riparian natural community in the Yolo Bypass and along south Delta waterways would have a beneficial impact on the community.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows at two new diversion structures at Georgianna Slough and Delta Cross Channel, the operation of multiple operable barriers in Delta waterways, modified diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs*. Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated changes in water levels over time with Alternative 9, as compared to no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not be expected to result in the permanent reduction in acreage of the valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of valley/foothill riparian natural community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP

(see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced nearly 20% in certain months of certain water-year types, and could be increased similarly in certain months of certain water-year types. Estimates of average changes range from less than 1% to more than 12% decreases in the July to November time frame when compared to No Action, while estimated average flow levels in the February to May time frame could increase between 1% and 7% with implementation of Alternative 9. Similar ranges in average flow changes below Sacramento are included in Appendix 11C, Section 11C.9. Tidal influence in the Sacramento River and Delta waterways would continue to be dominant such that there would be no substantial change in water levels that might affect in-stream and adjacent vegetation. Modified diversions from south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at Georgiana Slough and Delta Cross Channel associated with Alternative 9 could affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Increases in electrical conductivity (salinity) could occur in the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the Plan. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facilities and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management)*. Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging*. Long-term operation of the Alternative 9 diversions on the Sacramento River (Georgianna Slough and Delta Cross Channel) would include periodic dredging of sediments that might accumulate in front of intake and fish screens. Maintenance dredging would also be required in Middle River and Victoria Canal to maintain channel capacity. The dredging would occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on adjacent sensitive vegetation.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat. The BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *CM7 Riparian*

Natural Community Restoration and *CM3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM3, AMM4, AMM5, AMM6, AMM10, AMM18, and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect to the community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, AMM10, AMM18, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration and protection activities associated with *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of CM2, CM4, CM5, and CM6 would result in both permanent and temporary removal of this community (see Table 12-9-5). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the nontidal perennial aquatic natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal perennial aquatic natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-5. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	24	24	12	12	50–77	0
CM4	34	189	0	0	0	0
CM5	0	28	0	16	0	25
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**58**	**241**	**12**	**28**	**50–77**	**25**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM2, CM4, CM5, and CM6 would permanently eliminate an estimated 241 acres and temporarily remove 28 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 5% of the 5,567 acres of the community that is mapped in the study area. Approximately 26% (70 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 9 implementation, as habitat restoration is initiated. Natural communities restoration would add 1,200 acres of nontidal marsh over the life of the Plan (CM10), which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in Objective NFEW/NPANC1.1. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh, and that the restoration will occur in blocks that will be contiguous with the Plan's larger reserve system. The nontidal marsh will be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation actions would be implemented under Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would not affect nontidal perennial aquatic natural community.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels modifications, Putah Creek realignment activities, and Sacramento Weir and Tule Canal improvements. All of these activities could involve excavation and grading in nontidal perennial aquatic areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently lost and another 12 acres could be temporarily removed. This activity would occur primarily in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently change to tidally inundated or remove 189 acres of nontidal perennial aquatic community. These losses would be expected to occur primarily in the Cache Slough and Cosumnes/Mokelumne ROAs (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored during tidal habitat restoration (BDCP Objective NFEW/NPANC1.1, associated with CM10). Approximately 400 acres of the restoration would occur during the first 10 years of Alternative 9 implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be spread over the following 30 years. Nontidal natural communities restoration is expected to be focused in CZs 2, 4 and/or 5 identified in Figure 12-1.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would permanently remove 28 acres and temporarily remove 16 acres of nontidal perennial aquatic habitat. The construction-related losses would be considered a permanent removal of the nontidal perennial aquatic habitats. It is expected that floodplain restoration would be focused on the south part of the study area, in CZ 7. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Floodplain restoration along the southern Delta rivers would improve connectivity for a variety of species that rely on aquatic and riparian habitats. The regional and Plan Area landscape linkages along the San Joaquin River, Middle River and Old River are included in Figure 12-2. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the nontidal perennial aquatic community through CM2 construction losses (24 acres permanent and 12 acres temporary). These losses would occur primarily at scattered locations along the west side channels and the channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. Approximately 34 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The creation of 400 acres of nontidal marsh as part of CM10 during the first 10 years of Alternative 9 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 70 acres of restoration and 70 acres of protection would be needed to offset (i.e., mitigate) the 70 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in 5% losses of nontidal perennial aquatic community in the study area. These losses (241 acres of permanent and 28 acres of temporary loss) would be largely associated with construction of Yolo Bypass fish improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The changes in tidally influenced inundation would occur during the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored. The restoration would occur over a wide region of the study area, including within the Cosumnes/Mokelumne, Cache Slough and South Delta ROAs (see Figure 12-1).

NEPA Effects: During the first 10 years of implementing Alternative 9, creating 400 acres of nontidal marsh as part of CM10 would offset the construction-related and inundation losses of 70 acres of nontidal perennial aquatic natural community. There would be no adverse effect. During the full duration of Plan implementation, Alternative 9 would not result in a net reduction in the acreage of the nontidal perennial aquatic natural community; there would be an expansion of nontidal marsh and the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the loss of approximately 70 acres of nontidal perennial aquatic natural community due to construction of fish passage improvements (CM2), and change to tidally influenced inundation during tidal marsh restoration (CM4). The construction losses would occur primarily at scattered locations along the west side channels and the channels associated with the Sacramento and Lisbon Weirs in the Yolo Bypass. The 34 acres of the inundation and construction-related losses from CM4 would occur throughout several of the ROAs mapped in Figure 12-1. The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres of nontidal marsh scheduled for the first 10 years of Alternative 9 implementation (CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 70 acres of restoration and 70 acres of protection would be needed to offset (i.e., mitigate) the 70 acres of loss. While the Plan does not include protection of nontidal perennial aquatic habitat, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the lack of protection. The restoration and protection would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 269 acres of the natural community would be removed and 1,200 acres of nontidal marsh would be restored. The nontidal marsh would consist of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 9 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal perennial aquatic natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation of 50–77 acres of nontidal perennial aquatic natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plant*s. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 50-acre increase in inundation would be associated with a notch flow of 3,000 cubic feet per second (cfs), and the 77-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and patches throughout the bypass, including along the Tule Canal/Toe Drain, the western channels north of Interstate 80, and below the Fremont and Sacramento Weirs. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal perennial aquatic habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 25 acres of nontidal perennial aquatic habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal perennial aquatic habitats, especially as they relate to BDCP target aquatic species. The periodic flooding may also encourage germination of nontidal marsh vegetation.

In summary, 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5). Nontidal perennial aquatic community in the Yolo Bypass has developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal perennial aquatic natural community in the Yolo Bypass and along south Delta waterways associated with Alternative 9 would not reduce the acreage of this natural community and could encourage germination of aquatic vegetation. This increased inundation would not be adverse.

CEQA Conclusion: An estimated 75–102 acres of nontidal perennial aquatic community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. Nontidal perennial aquatic community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows at two newly screened sites at Georgianna Slough and Delta Cross Channel in the north Delta, the operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs*. Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 9 operations scheme would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this section of Delta waterways is tidally influenced. Modified diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and*

Management). Vegetation management is also the principal activity associated with *CM13 Invasive Aquatic Vegetation Control.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal perennial aquatic natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging*. Channel dredging associated with Alternative 9 would not affect this natural community. Nontidal wetlands are not connected to the tidal channels that would be dredged. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Reuse and Disposal of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on adjacent sensitive vegetation.
- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2–AMM6 and AMM10 would minimize these impacts, and other operations and maintenance activities would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *CM4 Tidal Natural Communities Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-9-6). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the nontidal freshwater perennial emergent wetland natural community.

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and manage 50 acres of occupied or recently occupied tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in Conservation Zones 1, 2, 8 or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation (Objective TRBL1.1).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of nontidal freshwater perennial emergent wetland natural community for terrestrial species. As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-6. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	1	1	24	24	0	0
CM2	25	25	1	1	6–8	0
CM4	40	99	0	0	0	0
CM5	0	0	0	0	0	8
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**66**	**125**	**25**	**25**	**6–8**	**8**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction and land grading activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 125 acres and temporarily remove 25 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 9% of the 1,509 acres of the community that is mapped in the study area. Approximately 60% (91 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 9 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Natural communities restoration would add 1,200 acres (CM10) and natural communities protection would protect 50 acres (CM3) of nontidal marsh over the course of Alternative 9 implementation, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities, as specified in BDCP Objective NFEW/NPANC1.1 (Table 3.3-1 in BDCP Chapter 3, *Conservation Strategy*). The nontidal marsh protection would be designed to support tricolored blackbird populations in the study area. The BDCP beneficial effects analysis (BDCP Chapter 5, Section 5.4.6.2) indicates that implementation of Alternative 4 would result in the restoration of 1,200 acres of nontidal marsh. The restoration would occur in blocks that are contiguous with the alternative's larger reserve system. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998). The same conservation actions would be implemented under Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would permanently remove 1 acre and temporarily remove 24 acres of tidal freshwater perennial emergent wetland community. The permanent loss would occur adjacent to Clifton Court Forebay where the new canal would cross Coney Island (see Terrestrial Biology Mapbook). The temporary losses would occur in temporary dredging work areas along Middle River between Victoria Canal and Mildred Island. These wetlands occur in small patches, primarily on the interiors of islands within the Middle River corridor. These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, west side channels and Tule Canal modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Some of these activities could involve excavation and grading in nontidal freshwater perennial emergent wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 25 acres could be permanently lost and 1 acre could be temporarily removed. These losses would most likely occur in the Tule Canal and west side channels at the north end of the bypass. The habitat there includes narrow bands within these side channels of the bypass and is isolated from other marsh or open water habitats. The narrow bands are bordered by riparian habitats, primarily willows and cottonwoods. This activity would occur in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 99 acres of nontidal freshwater perennial emergent wetland community. These losses would be expected to occur primarily in the Cache Slough ROA (see Figure 12-1). An estimated 1,200 acres of nontidal marsh would be restored (CM10) and 50 acres would be protected (CM3) during nontidal habitat conservation actions. Approximately 400 acres of the restoration and 25 acres of the protection would occur during the first 10 years of Alternative 9 implementation, which would coincide with the timeframe of water conveyance facilities construction and early tidal marsh restoration. The remaining restoration would be spread over the following 30 years. Nontidal marsh natural communities restoration is expected to be focused in the vicinity of giant garter snake populations in the eastern Delta and near the Yolo Bypass.
- *CM5 Seasonally Inundated Floodplain Restoration*: Based on theoretical footprints, floodplain restoration levee construction would not affect nontidal freshwater perennial emergent wetland natural community.
- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM10 Nontidal Marsh Restoration*: CM10 would entail restoration of 1,200 acres of nontidal marsh in CZs 2, 4 and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the nontidal freshwater perennial emergent wetland community through CM1 construction losses (1 acre permanent and 24 acres temporary) and the CM2 construction losses (25 acres permanent and 1 acre temporary). These losses would occur on Coney Island, within the Middle River dredging corridor, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur throughout several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 400 acres and protection of 25 acres of nontidal marsh as part of CM3 and CM10 during the first 10 years of Alternative 9 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 91 acres of restoration and 91 acres of protection would be needed to offset (i.e., mitigate) the 91 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in a 9% loss of nontidal freshwater perennial emergent wetland community in the study area. These losses (125 acres of permanent and 25 acres of temporary loss) would be largely associated with construction of the Yolo Bypass fish passage improvement facilities (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur through the course of the CM4 restoration activities at various tidal restoration sites throughout the study area. By the end of the Plan timeframe, a total of 1,200 acres of nontidal marsh would be restored and 50 acres would be protected. The restoration would occur near giant garter snake occupied habitat in the eastern Delta and near Yolo Bypass, in CZs 2, 4, and

5. The 50 acres of protection would occur in CZ 1, 2, 8, or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: In the near-term, the combination of creating 400 acres and protecting 25 acres of nontidal perennial marsh as part of CM3 and CM10 would offset the near-term losses associated with construction of CM1, CM2, and CM4 facilities, avoiding any adverse effect. With 1,200 acres of nontidal marsh restoration (BDCP Objective NFEW/NPANC1.1) and 50 acres of protection (BDCP Objective TRBL1.1) included with full implementation of the Plan, Alternative 9 would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would be beneficial.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the loss of approximately 91 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities (CM1) and fish passage improvements (CM2), and inundation during tidal marsh restoration (CM4). The construction losses would occur on Coney Island, within the Middle River dredging corridor, and in the Yolo Bypass. Approximately 40 acres of the inundation and construction-related losses from CM4 would occur in the near-term. These losses would occur throughout several of the ROAs mapped in Figure 12-1.

The losses would be spread across a 10-year near-term timeframe. These losses would be offset by planned restoration of 400 acres and protection of 25 acres of nontidal marsh scheduled for the first 10 years of Alternative 9 implementation (CM3 and CM10). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 91 acres of restoration and 91 acres of protection would be needed to offset (i.e., mitigate) the 91 acres of loss. While the Plan includes just 25 acres of protection in the near-term, it includes well in excess of the typical 1:1 restoration acreage (which includes protection in perpetuity), and therefore compensates for the shortfall in protection. The restoration and protection would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community.

Late Long-Term Timeframe

At the end of the Plan period, 150 acres of the natural community would be removed, 1,200 acres of nontidal marsh would be restored (BDCP Objective NFEW/NPANC1.1) and 50 acres of nontidal marsh would be protected (BDCP Objective TRBL1.1). There would be no net permanent reduction in the acreage of this sensitive natural community within the study area. Therefore, Alternative 9 would not have a substantial adverse effect on this natural community; the impact would be beneficial.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of nontidal freshwater perennial emergent wetland natural community on small acreages, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency and duration of inundation of 6-8 acres of nontidal freshwater perennial emergent wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 6-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 8-acre increase would result from a notch flow of 6,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. This community occurs in small stringers and isolated patches along the Tule Canal and western channel in the north end of the bypass. These areas are not connected to other adjacent marsh and open water habitats; they are surrounded by riparian habitat, scoured grassland and agricultural lands. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect the ecological function of this natural community and would not substantially modify its value for special-status or common wildlife species. Nontidal freshwater perennial emergent wetland plant species in the Yolo Bypass have developed under a long-term regime of periodic inundation events. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes. The effects of this increased inundation on terrestrial wildlife and plant species are described in detail in later sections of this chapter.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 8 acres of nontidal freshwater perennial emergent wetland habitat. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The reconnection of these wetlands to stream flooding events would be beneficial to the ecological function of nontidal freshwater perennial emergent wetland habitats, as they relate to BDCP target aquatic species. The added exposure to inundation could also encourage germination of nontidal marsh plant species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species.

In summary, 14–16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5). This community would not be adversely affected because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent.

NEPA Effects: The increased inundation of nontidal freshwater perennial emergent wetland natural community in the Yolo Bypass and in the southern Delta would not reduce the acreage of this natural community and could encourage germination of emergent wetland vegetation. The increased inundation would not be an adverse effect.

CEQA Conclusion: An estimated 14–16 acres of nontidal freshwater perennial emergent wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. This community would not be significantly impacted because its habitats in the Yolo Bypass have developed under a long-term regime of periodic inundation events and inundation along expanded river floodplains would be infrequent. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows at two newly screened diversions at Georgianna Slough and Delta Cross Channel, the operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs*. Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal freshwater perennial emergent wetland community would be reduced on a permanent basis. Some minor increases and some decreases could be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, modified diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Flow volumes in these two diversions and in the downstream channels that had been dredged (Middle River and Victoria Canal) would increase under certain Sacramento River flow conditions and water year types. However, tidal influence

in the Sacramento River and Delta waterways would continue to be dominant such that there would be no substantial change in water levels that might affect in-stream and adjacent vegetation. Modified diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- Vegetation management. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

  Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use tidal and nontidal freshwater perennial emergent wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Channel dredging*. Channel dredging associated with Alternative 9 would not affect this natural community. Nontidal freshwater perennial emergent wetlands are not directly connected to the tidal channels that would be dredged. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control*

Plan, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on adjacent sensitive vegetation.

- Habitat enhancement. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of CM2 and CM4 would result in permanent removal of this community (see Table 12-9-7). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the alkali seasonal wetland natural community.

- Protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8 and/or 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in Conservation Zones 1, 8, and/or 11 to achieve no net loss of wetted acres (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of alkali seasonal wetland natural community for terrestrial species. As explained below, with the protection, restoration, and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-7. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	45	45	0	0	264–744	0
CM4	13	27	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**58**	**72**	**0**	**0**	**264–744**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM2 and CM4 would permanently eliminate an estimated 72 acres of alkali seasonal wetland complex natural community in the study area. These modifications represent approximately 2% of the 3,723 acres of the community that is mapped in the study area. Most of the losses (58 acres or 80%) would occur during the first 10 years of Alternative 9 implementation, as Yolo Bypass improvements and habitat restoration is initiated. Alkali seasonal wetland complex protection (120 acres) and restoration (an estimated 58 acres, but determined by actual level of effect) would be initiated during the same period, which would offset the losses. By the end of the Plan period, 150 acres of this natural community would be protected and 72 acres would be restored. The BDCP beneficial effects analysis for this community (BDCP Chapter 5, Section 5.4.7.2) states that Alternative 4 would protect 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, or 11, in a mosaic of protected grasslands and vernal pool complex. This would protect currently unprotected high-value alkali seasonal wetland complex in the Plan Area. These same conservation actions would be implemented under Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would not directly affect alkali seasonal wetland complex natural community. The construction activity associated with CM1, however, has the potential to indirectly cause increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction of the canals around Clifton Court Forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at the forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. Realignment of Putah Creek could involve excavation and grading in alkali seasonal wetland complex as a new channel is constructed. Based on hypothetical construction footprints, a total of 45 acres could be permanently lost. This complex is located immediately south of the existing Putah Creek channel within the bypass and is a relatively large, moderate to high value, contiguous expanse of this community. This loss would occur in the near-term timeframe.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 150 acres of alkali seasonal wetland complex in CZs 1, 8 and 11 (BDCP Objective ASWNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13 acres of alkali seasonal wetland complex in the near-term and inundate or remove 27 acres by the end of the Plan timeframe. The losses would be expected to occur in the Cache Slough and Suisun Marsh ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the Lindsay Slough area and on the northern fringes of Suisun Marsh, north of the Potrero Hills. These losses would not fragment the alkali seasonal wetland communities adjacent to these sloughs because the losses would occur on the edges of the existing habitat.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the conservation measure is to match the acreage of restoration with the actual acreage lost to other conservation measures (primarily CM2 and CM4). The current estimate for alkali seasonal wetland complex restoration is 58 acres in the near-term and a total of 72 acres by the end of the BDCP restoration period. The goal is for no net loss of this natural community, consistent with BDCP Objective ASWNC1.2. Restoration in the Lindsay Slough area of the Cache Slough ROA and the northern region of the Suisun Marsh ROA would be consistent with essential habitat connectivity goals mapped in Figure 12-2 and described in Table 3.2-3 of BDCP Chapter 3, *Conservation Strategy*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the alkali seasonal wetland complex natural community through CM2 construction losses (45 acres). These losses would occur in the Yolo Bypass south of Putah Creek. Approximately 13 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These losses would occur primarily in the Cache Slough and Suisun Marsh ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of 58 acres of this community as part of CM9 during the first 10 years of Alternative 9 implementation would offset this near-term loss, avoiding any adverse effect. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres of restoration would be needed to offset (i.e., mitigate) the 58 acres of loss.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in relatively minor (2%) losses of alkali seasonal wetland natural community in the study area. These losses (72 acres) would be associated with construction of Yolo Bypass fish improvements (CM2) and inundation during tidal marsh restoration (CM4). Inundation losses would occur through the course of the BDCP restoration activities, primarily in the Cache Slough and Suisun Marsh ROAs.

NEPA Effects: In the first 10 years of implementing Alternative 9 conservation measures, 120 acres of alkali seasonal wetland complex would be protected as part of CM3 and 58 acres of this community would be restored as part of CM9. These conservation actions would offset the near-term loss of this community associated with CM2 and CM4, avoiding any adverse effect. By the end of the Plan timeframe, Alternative 9 would protect a total of 150 acres of alkali seasonal wetland natural community (CM3) and would restore up to 72 acres (CM9). The protection and restoration would occur primarily in CZ 1, CZ 8 and/or CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Therefore, Alternative 9 would not have an adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the permanent loss of approximately 58 acres of alkali seasonal wetland complex natural community due to construction of fish passage improvements (CM2) and inundation during tidal marsh restoration (CM4). The construction losses would occur primarily in the area just south of Putah Creek in the Yolo Bypass, while inundation losses would occur in the Cache Slough and Suisun Marsh ROAs. The losses would be spread across a 10-year near-term timeframe.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 120 acres of alkali seasonal wetland complex as part of CM3 and the restoration of 58 acres of this community as part of CM9 during the first 10 years of Alternative 9 implementation would offset this near-term loss, avoiding any significant impact. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 116 acres of protection and 58 acres or restoration would be needed to offset (i.e., mitigate) the 58 acres of loss. Also, AMM1, AMM2, AMM3, AMM4, and AMM10 would be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 72 acres of alkali seasonal wetland complex natural community would be permanently removed by conservation actions, 150 acres would be protected and up to 72 acres would be restored. The restoration acres actually developed would depend on the number of acres affected during Plan implementation. There would be no net permanent reduction in the acreage of this natural community within the study area. Therefore, Alternative 9 would have a less-than-significant impact on this natural community.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of alkali seasonal wetland complex natural community at scattered locations in the central and southern sections of the bypass.

Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation on an estimated 264–744 acres of alkali seasonal wetland complex natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 264-acre increase in inundation would be associated with a notch flow of 1,000 cubic feet per second (cfs), and the 744-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The alkali seasonal wetland complex natural community occurs primarily in the central and southern reaches of the bypass, south of Putah Creek. The stands in this location are relatively large, with moderate to high value for associated plant and wildlife species. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 9 would not adversely affect alkali seasonal wetland complex habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in plant species composition as a result of longer inundation periods, but the natural community would persist.

CEQA Conclusion: An estimated 264–744 acres of alkali seasonal wetland complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 9. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of alkali seasonal wetland complex natural community in the Yolo Bypass would have a less-than-significant impact on the natural community. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at two newly screened diversions at Georgianna Slough and Delta Cross Channel, modified diversions from south Delta channels, and recreation in and adjacent to Plan reserves. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, and modified diversions from south Delta channels (Operational Scenario G) would not affect alkali seasonal wetland complex natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (CM11 Natural Communities Enhancement and Management). Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *CM3 Natural Communities Protection and Restoration*, and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the alkali seasonal wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases in sedimentation in this community. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Initial development and construction of CM4 would result in permanent removal of 372 acres of this community (see Table 12-9-8). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the vernal pool complex natural community.

- Protect 600 acres of existing vernal pool complex in Conservation Zones 1, 8, and 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in Conservation Zones 1, 8, and/or 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of vernal pool complex natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-8. Changes in Vernal Pool Complex Natural Community Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0–4	0
CM4	201	372	0	0	0	0
CM5	0	0	0	0	0	0
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**201**	**372**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, land grading and habitat restoration activities that would accompany the implementation of CM4 could permanently eliminate an estimated 372 acres of vernal pool complex natural community in the study area. This modification represents approximately 3% of the 12,133 acres of the community that is mapped in the study area. An estimated 201 acres of this loss would occur during the first 10 years of Alternative 9 implementation, as tidal marsh restoration is initiated. Vernal pool complex protection (400 acres) and restoration (an estimated 40 acres, with actual restoration based on level of effect) would be initiated during the same period to counteract the loss of habitat. By the end of the Plan period, 600 acres of this natural community would be protected and up to 67 acres would be restored. There is also a commitment to having restoration activities keep pace with actual loss of vernal pool habitat through the course of CM4 activities (BDCP Chapter 3, Section 3.4.4.27). Because of the high sensitivity of this natural community and its shrinking presence in the Plan Area, avoidance and minimization measures have been built into the BDCP to eliminate the majority of this potential loss. The BDCP beneficial effect analysis (BDCP Chapter 5, Section 5.4.8.2) indicates that implementation of Alternative 4 would protect at least 600 acres of vernal pool complex in Conservation Zones 1, 8, and 11 and additional vernal pool complex would be restored to achieve no net loss of this community. The same conservation actions would be implemented under Alternative 9.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would not directly affect vernal pool complex natural community. Because of the close proximity of construction activity to adjacent vernal pool complex near Clifton Court Forebay, there is the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis later in this chapter.

  The construction activity associated with CM1 also has the potential to lead indirectly to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction of canals in the vicinity of the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM3 Natural Communities Protection and Restoration*: CM3 proposes to protect at least 600 acres of vernal pool complex in CZs 1, 8 and 11 (BDCP Objective VPNC1.1). The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.

- *CM4 Tidal Natural Communities Restoration:* Based on the use of hypothetical restoration footprints, implementation of CM4 tidal marsh restoration in CZs 1 and 11 (Cache Slough and Suisun Marsh ROAs; see Figure 12-1) could permanently inundate or remove 201 acres of vernal pool complex in the near-term timeframe. By the end of the Plan period, a total of 372 acres could be affected. The principal areas likely to be affected include the Cache Slough drainage just west of the Yolo Bypass and the Nurse Slough drainage just east of the Potrero Hills.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: BDCP CM9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool complex restoration is 40 acres in the near-term and a total of 67 acres by the end of the BDCP restoration period. This restoration conservation measure includes a "no net loss" policy normally applied to this natural community (BDCP Objective VPNC1.2).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 could affect 201 acres of vernal pool complex natural community through inundation or construction-related losses in habitat from CM4 activities. This loss would likely occur in the Cache Slough or Suisun Marsh ROAs mapped in Figure 12-1.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of up to 40 acres of this community as part of CM9 during the first 10 years of Alternative 9 implementation would partially offset this near-term loss. The Plan focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 402 acres of protection and 201 acre of restoration would be needed to offset (i.e., mitigate) the 201 acre of loss. Without additional avoidance and minimization measures to reduce the potential effect, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses.

To avoid this adverse effect, the Plan includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM12 Vernal Pool Crustaceans.* AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. This is equivalent to the direct removal of approximately 67 acres and the indirect removal of approximately 134 acres of vernal pool complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. With these AMMs in place, Alternative 9 would not adversely affect vernal pool complex natural community in the near-term.

Late Long-Term Timeframe

The late long-term effect on vernal pool complex natural community would be 372 acres of permanent loss. These losses would be associated with the ongoing restoration of tidal wetland in the Cache Slough and Suisun Marsh ROAs. However, 600 acres would be protected (CM3) and up to 67 acres would be restored (CM9) through the course of the BDCP implementation. In addition, the avoidance and minimization measures listed above would reduce the actual loss of this community to no more than 10 wetted acres of vernal pool crustacean habitat from direct activities and 20 acres of habitat from indirect effects.

NEPA Effects: The conservation measures associated with Alternative 9 include protection of 400 acres (CM3) and restoration of an estimated 40 acres (CM9) of vernal pool complex in the near-term time frame. The Plan focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8 and CZ 11 (see Figure 12-1). In addition, Alternative 9 includes AMM12 which limits the removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. With this and other AMMs in place, Alternative 9 would not adversely affect vernal pool complex natural community in the near-term. With these conservation measures and AMMs in effect through the entire Plan period, Alternative 9 would not have an adverse effect on the vernal pool complex natural community in the long term.

***CEQA Conclusion*:**

Near-Term Timeframe

During the 10-year near-term time frame, Alternative 9 could result in the loss of approximately 201 acres of vernal pool complex natural community due to inundation during tidal marsh restoration (CM4). The loss would likely occur in the Cache Slough or Suisun Marsh ROAs.

The inundation loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with BDCP conservation components. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 400 acres of vernal pool complex as part of CM3 and the restoration of an estimated 40 acres of this community as part of CM9 during the first 10 years of Alternative 9 implementation would partially offset this near-term loss. CM9 also includes a commitment to have vernal pool restoration keep pace with loss of this natural community. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 402 acres of protection and 201 acres of restoration would be needed to offset (i.e., mitigate) the 201 acre of loss. Without additional avoidance and minimization measures to reduce the potential impact, the proposed protection and restoration would not meet the typical mitigation for vernal pool complex losses. However, Alternative 9 also includes AMM1, AMM2, AMM3, AMM4, AMM10, and AMM12 to minimize impacts. AMM12 places a strict limit on the acres of wetted vernal pool crustacean habitat that can be lost to conservation actions (10 acres of direct and 20 acres of indirect loss; equivalent to approximately 67 acres of direct loss and 134 acres of indirect loss of vernal pool natural community). Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Late Long-Term Timeframe

At the end of the Plan period, 372 acres of vernal pool complex natural community could be permanently removed. Through CM3 and CM9, 600 acres of vernal pool complex natural community would be protected and up to 67 acres would be restored. In addition, AMM12 would limit the acres of wetted vernal pool crustacean habitat loss to 10 acres from direct actions and 20 acres from indirect actions. There would be no net permanent reduction in the acreage of this natural community within the study area. Alternative 9 would have a less-than-significant impact on this natural community.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

CM2 Yolo Bypass Fisheries Enhancement would modify the inundation regime of the Yolo Bypass, a man-made waterway. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, could increase periodic inundation of a small acreage of vernal pool complex natural community in the southern section of the bypass, south of Putah Creek.

Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation on an estimated 0–4 acres of vernal pool complex natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix

5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 4-acre increase in inundation would only occur at the highest modeled flow regime, 8,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The vernal pool complex natural community that would likely be affected occurs in the southern reaches of the bypass, south of Putah Creek. There are several relatively large, contiguous areas of vernal pools on the western edge of the bypass in this area. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May).

NEPA Effects: The modification of periodic inundation events in the Yolo Bypass associated with Alternative 9 water operations would not adversely affect vernal pool complex habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential, however, for some change in plant species composition as a result of longer inundation periods.

CEQA Conclusion: An estimated 0–4 acres of vernal pool complex natural community in the Yolo Bypass would be subjected to more frequent inundation as a result of implementing CM2 under Alternative 9. This natural community is conditioned to periodic inundation; the slight increase in periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area, although some change in plant species composition could occur. Increasing periodic inundation of vernal pool complex natural community in the Yolo Bypass would have a less-than-significant impact on the community.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include the diversion of Sacramento River flows into newly screened diversion structures at Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, modified diversions from south Delta channels, and recreation activities in Plan reserves. These actions are associated with CM1 and CM11 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at newly screened diversions into Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels (Operational Scenario G) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways.

- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as part of *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect vernal pool habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10 and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on this community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation or damage from recreational activity in this community. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Managed Wetland

The conservation components of Alternative 9 would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of CM1, CM2, CM4, and CM6 would result in both permanent and temporary removal of this community (see Table 12-9-9). Full implementation of Alternative 9 would also include the following conservation action over the term of the BDCP to benefit the managed wetland natural community.

- Protect and enhance 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 320 acres of managed wetlands consisting of greater sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in Conservation Zones 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events (Objective GSHC1.3, associated with CM10).
- Create two wetland complexes within the SLNWR refuge boundary. Each complex will consist of at least three wetlands totaling 90 acres of greater sandhill crane roosting habitat. One of the

wetland complexes may be replaced by 180 acres of cultivated lands that are flooded following harvest for crane roosting and foraging habitat (Objective GSHC1.4, associated with CM10).

In addition to this conservation action, creation of similar habitat values by restoring tidal brackish emergent wetland and tidal freshwater emergent wetland as part of CM4 would further offset the losses of managed wetland. The net effect would be a substantial decrease in the amount of managed wetlands, but an increase in similar habitat value for special-status and common species as the managed wetland is converted to tidal marsh. Impacts to this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to the *Shorebirds and Waterfowl* impact discussion at the end of this section (Section 12.3.3.16) for further consideration of the effects of removing managed wetland natural community.

Table 12-9-9. Changes in Managed Wetland Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	9	9	23	23	0	0
CM2	24	24	44	44	931–2,612	0
CM4	5,718	13,746	0	0	0	0
CM5	0	0	0	0	0	6
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**5,751**	**13,779**	**67**	**67**	931–2,612	**6**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, channel dredging, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, and CM6 would permanently eliminate an estimated 13,779 acres of managed wetland in the study area. This modification represents approximately 19% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur through the course of BDCP restoration activity, as construction and tidal marsh restoration proceeds. Managed wetland protection (8,100 acres) and restoration (500 acres) would take place over the same period, but would not replace the acreage lost. The BDCP beneficial effects analysis for Alternative 4 (BDCP Chapter 5, Section 5.4.9.2) states that at least 8,100 acres of managed wetlands would be protected, of which at least 1,500 acres will be located within the Grizzly Island marsh complex, consistent with the U.S. Fish and Wildlife Service salt marsh harvest mouse recovery plan. Although the primary purpose of the 1,500 acres of protection is to protect and enhance habitat for the salt marsh harvest mouse, it is also expected to benefit the managed wetland natural community and the diversity of species that use it, including migratory waterfowl and the western pond turtle. These same conservation actions would be implemented under Alternative 9.

The individual effects of the relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would permanently remove 9 acres and temporarily remove 23 acres of managed wetland community. The permanent losses would occur at canal construction sites over the Old River just south of Clifton Court Forebay and across Coney Island, and at a spoil storage site adjacent to the operable barrier constructed at the northern junction of Old River and the San Joaquin River at Franks Tract. The temporary losses would occur at the Old River canal crossing adjacent to Clifton Court Forebay, at the Old River/San Joaquin River operable barrier at Franks Tract, and at a work area adjacent to the Delta Cross Channel diversion construction site (see Terrestrial Biology Mapbook). These losses would take place during the near-term construction period.
- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities that could permanently or temporarily remove managed wetland, including west side channels modifications, Putah Creek realignment activities, Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in managed wetland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 24 acres could be permanently removed and 44 acres could be temporarily removed. This activity would occur in the near-term timeframe.
- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 13,746 acres of managed wetland community. These losses would be expected to occur primarily in the Suisun Marsh ROA, but could also occur in the Cache Slough and West Delta ROAs (see Figure 12-1). These acres of managed wetland would be converted to natural wetland, including large acreages of tidal brackish emergent wetland and tidal freshwater emergent wetland. These natural wetlands provide comparable or improved habitat for the special-status species that occupy managed wetland. The newly created tidal marsh would not create a barrier or result in fragmentation of managed wetland, as most species are capable of utilizing both communities. An estimated 500 acres of managed wetland would be restored and 8,100 acres would be enhanced and protected through *CM3 Natural Communities Protection and Restoration,* as established by BDCP Objective MWNC1.1. All of the restoration and 4,800 acres of the protection would occur during the first 10 years of Alternative 9 implementation, which would coincide with the timeframe of water conveyance facilities construction and early implementation of CM4. The remaining restoration would be spread over the following 30 years. Managed wetland restoration is expected to include at least 320 acres in CZs 3, 4, 5 and 6 (Figure 12-1) to benefit sandhill crane, as stated in BDCP Objective GSHC1.3. The enhancement and protection would be focused in Suisun Marsh, but could also occur in CZs with existing managed wetland (CZs 1, 2, 4, 5, 6, and 7).

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would permanently remove 5,751 acres and temporarily remove 67 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Thirty-two acres of this loss would be associated with construction of the water conveyance facilities (CM1). These losses would occur in various locations, but the majority of the near-term loss would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent an adverse effect if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 500 acres (CM10) and protection and enhancement of 4,800 acres (CM3) of managed wetland during the first 10 years of Alternative 9 implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. The typical project-level mitigation ratio (1:1 for protection) would indicate 32 acres of protection would be needed to offset the 32 acres of loss associated with CM1; a total of 5,818 acres of protection would be needed to offset (i.e., mitigate) the 5,818 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 518 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetlands lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section (Section 12.3.3.16).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 9, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be an adverse effect when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 8,850 acres of tidal freshwater emergent wetland) would offset this adverse effect. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

Late Long-Term Timeframe

At the end of the Plan period, 13,779 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland.

NEPA Effects: Alternative 9 would result in a loss 13,779 acres of managed wetland within the study area; however, it would also protect and enhance 8,100 acres and restore 500 acres of this habitat. In addition, Alternative 9 would restore 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland that support similar ecological functions to those of managed wetland. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion:

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would permanently remove 5,571 acres and temporarily remove 67 acres of managed wetland through inundation or construction-related losses in habitat from CM1, CM2, and CM4 activities. Thirty-two acres of this loss would be associated with construction of the water conveyance facilities (CM1). These losses would occur in various locations, but the majority of the near-term loss would occur in Suisun Marsh and the lower Yolo Bypass as tidal marsh is restored.

The construction or inundation loss of this special-status natural community would represent a significant impact if it were not offset by other conservation actions. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 500 acres and protection and enhancement of 4,800 acres of managed wetland as part of CM3 and CM10 during the first 10 years of Alternative 9 implementation would fully offset the losses associated with CM1, but would only partially offset the total near-term loss. The typical project-level mitigation ratio (1:1 for protection) would indicate 32 acres of protection would be needed to offset the 32 acres of loss associated with CM1; a total of 5,818 acres of protection would be needed to offset (i.e., mitigate) the 5,818 acres of permanent and temporary loss from all near-term actions. The combined protection and restoration proposed for managed wetland in the near-term would fall 518 acres short of full replacement. However, the CM4 marsh restoration activities that would be creating this loss would be simultaneously creating 2,000 acres of tidal brackish emergent wetland and 4,800 acres of tidal freshwater emergent wetland in place of the managed wetland in the near-term. This acreage would significantly exceed the number of acres of managed wetland lost. Mitigation measures would also be undertaken to reduce the effects of managed wetland loss on waterfowl in Suisun Marsh (Mitigation Measure BIO-179a) and the Yolo/Delta basins (Mitigation Measure 179b) if the protection and enhancement actions of CM3 and CM10 were not sufficient to replace the value of managed wetlands for waterfowl in these basins. Refer to the *General Terrestrial Biology Effects* discussion later in this section (Section 12.3.3.16).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 9, there would be a net reduction in the acreage of this special-status natural community in the near-term. This would be a significant impact when judged by the significance criteria listed earlier in this chapter. However, the conversion of these managed habitats to natural tidal wetland types that support similar ecological functions (2,000 acres of tidal brackish emergent wetland and 4,800 acres of tidal freshwater emergent wetland) would eliminate this significant impact. Also, there are other conservation actions contained in the BDCP (CM3 and CM11) that would improve management and enhance existing habitat values, further offsetting the impacts of managed wetland loss on covered and noncovered special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Late Long-Term Timeframe

At the end of the Plan period, 13,779 acres of managed wetland natural community would be permanently removed by conservation actions, 8,100 acres would be protected and 500 acres would be restored. There would be a net permanent reduction in the acreage of this special-status natural community within the study area. Simultaneously, there would be the creation of 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland in place of this managed wetland. Because these natural wetlands support similar ecological functions to those of managed wetland, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of managed wetland on wildlife management areas and duck clubs scattered up and down the central and southern bypass. CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways in the south Delta.

- *CM2 Yolo Bypass Fisheries Enhancement*: Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation of 931–2,612 acres of managed wetland natural community. The methods used to estimate these inundation acreages are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 931-acre increase in inundation would be associated with a notch flow of 8,000 cubic feet per second (cfs), and the 2,612-acre increase would result from a notch flow of 4,000 cfs. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. Based on the theoretical modeling that has been completed to-date, the largest acreages would be associated with the Sacramento Bypass Wildlife Area, the Yolo Bypass Wildlife Area, and private managed wetlands south of Putah Creek. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). With larger flows, the water depths may also increase over Existing Conditions. While the managed wetlands of the Yolo Bypass are conditioned to periodic inundation events, the more frequent and extended inundation periods may make it more difficult to actively manage the areas for maximum food production for certain species (waterfowl primarily) and may alter the plant assemblages in some years. The effects of this periodic inundation on birds and other terrestrial species are discussed later in this chapter. The additional inundation would not be expected to reduce the acreage of managed wetland on a permanent basis. The extended inundation would be designed to expand foraging and spawning habitat for Delta fishes.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of an estimated 6 acres of managed wetland. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels. The connection of these wetlands to stream flooding events would be beneficial to the ecological function of managed wetlands, especially as they relate to BDCP target aquatic species. Foraging activity and refuge sites would be expanded into areas currently unavailable or infrequently available to some aquatic species. The more frequent flooding would periodically interfere with management activities associated with terrestrial species (primarily waterfowl) and may result in changes in plant composition and management strategies over time.

In summary, 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5).

NEPA Effects: Managed wetland community would not be adversely affected because much of the acreage affected is conditioned to periodic inundation. The more frequent inundation could create management problems associated with certain species, especially waterfowl, and result in changes over time in plant species composition. The total acreage of managed wetland would not be expected to change permanently as a result of the periodic inundation.

CEQA Conclusion: An estimated 937–2,618 acres of managed wetland community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. Managed wetland community would not be significantly impacted because periodic inundation is already experienced by most of the land that would be affected. There could be increased management problems and a long-term shift in plant species composition. The periodic inundation would not be expected to result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be a less-than-significant impact on the community.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows into two newly screened diversions at Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, modified diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with CM1 and CM11 (see the above impact discussion for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at two newly screened diversions at Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels (Operational Scenario G) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, modified diversions of Sacramento River flows in at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Modified diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Resources Enhancement and Management)*. Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

Herbicides to remove aquatic invasive species as part of CM13 would be used to restore the normal ecological function of tidal and nontidal aquatic habitats in planned restoration areas. The treatment activities would be conducted in concert with the California Department of Boating and Waterways' invasive species removal program. Eliminating large stands of water hyacinth and Brazilian waterweed would improve habitat conditions for some aquatic species by removing cover for nonnative predators, improving water flow and removing barriers to movement (see Chapter 11, *Fish and Aquatic Resources*). These habitat changes should also benefit terrestrial species that use managed wetland natural community for movement corridors and for foraging. Vegetation management effects on individual species are discussed in the species sections on following pages.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The BDCP would allow hunting, fishing and hiking in managed wetland reserve areas. *CM11 Natural Communities Enhancement and Management* (BDCP Chapter 3, Section 3.4.11) describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat. BDCP also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural*

Communities Enhancement and Management, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM4 Tidal Natural Communities Restoration, CM10 Nontidal Marsh Restoration* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in acreage of the managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5 and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *CM10 Nontidal Marsh Restoration and CM4 Tidal Natural Communities Restoration* and protection and restoration actions associated with *CM3 Natural Communities Protection and Restoration* would expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the eastern area of additional analysis; see Figure 12-1) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the eastern extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7 (Figure 12-1). The only BDCP conservation component that would potentially affect this natural community is the seasonally inundated floodplain restoration conservation measure (CM5) (see Table 12-9-10).

Table 12-9-10. Changes in Other Natural Seasonal Wetland Associated with Alternative 9 (acres)[a]

	Permanent		Temporary		Periodic[d]	
Conservation Measure[b]	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	0	0
CM2	0	0	0	0	0	0
CM4	0	0	0	0	0	0
CM5	0	0	0	0	0	2
CM6	Unk.	Unk.	Unk.	Unk.	0	0
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing BDCP Conservation Measures

Based on theoretical footprints for this activity, *CM5 Seasonally Inundated Floodplain Restoration* could expose 2 acres of other natural seasonal wetland community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways throughout the study area. Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels, including the channels of Old River and Middle River. Several small patches of other natural seasonal wetland natural community are mapped along these waterways. The exposure of these seasonal wetlands to increased but infrequent episodes of stream flooding would not alter their ecological function or species composition. Their value to special-status and common plants and wildlife in the study area would not be affected. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.

NEPA Effects: Alternative 9 conservation actions would not adversely affect other natural seasonal wetland natural community because the small increase in periodic flooding of up to 2 acres would not alter its function or general species makeup.

CEQA Conclusion: An estimated 2 acres of other natural seasonal wetland community in the study area would be subjected to more frequent inundation from flood flows as a result of implementing CM5 under Alternative 9. This community would not be significantly impacted because a small increase in periodic flooding would not alter its ecological function or species composition. The periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Therefore, there would be no substantial adverse effect on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels*. Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel, operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels (Operational Scenario G) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.
- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces, as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management)*. Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also

reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared to the restoration activities planned as part of *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool complex conservation measure includes restoration of 139 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the other natural seasonal wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact.

Grassland

Construction, operation, maintenance and management associated with the conservation components of Alternative 9 would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would result in both permanent and temporary removal of this community (see Table 12-9-11). Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the grassland natural community.

- Protect 8,000 acres of grassland with at least 2,000 acres protected in Conservation Zone 1, at least 1,000 acres protected in Conservation Zone 8, and at least 2,000 acres protected in Conservation Zone 11 (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland and to provide upland habitat adjacent to riparian, tidal, and nontidal natural communities for wildlife foraging and upland refugia (Objective GNC1.2, associated with CM3 and CM8).
- Of the 8,000 acres of grassland protected and at least 2,000 acres of grassland restored, protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide 200 feet of adjacent grasslands beyond the sea level rise accommodation (Objective GNC1.4, associated with CM3 and CM8).

There is a variety of other, less specific conservation goals and objectives in BDCP Chapter 3, Section 3.3 that would improve the value of grassland natural community for terrestrial species. As explained below, with the protection, restoration and enhancement of the amounts of habitat listed in the BDCP objectives, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-11. Changes in Grassland Natural Community Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	82	82	344	344	0	0
CM2	388	388	239	239	385–1,277	0
CM4	448	1,122	0	0	0	0
CM5	0	51	0	34	0	514
CM6	Unk.	Unk.	Unk.	Unk.	0	0
CM7	4	410	0	0	0	0
CM11	13	50	0	0	0	0
CM18	35	35	0	0	0	0
TOTAL IMPACTS	**970**	**2,138**	**583**	**617**	**385–1,277**	**514**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
Unk. = unknown

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing BDCP Conservation Measures

Construction, channel dredging, land grading and habitat restoration activities that would accompany the implementation of CM1, CM2, CM4, CM5, CM6, CM7, CM11 and CM18 would permanently eliminate an estimated 2,138 acres and temporarily remove 617 acres of grassland natural community in the study area. These modifications represent approximately 3% of the 78,047 acres of the community that is mapped in the study area. Approximately 56% (1,553 acres) of the permanent and temporary losses would occur during the first 10 years of Alternative 9 implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Grassland protection (2,000 acres) and restoration (1,140 acres) would be initiated during the same period. By the end of the Plan period, 2,000 acres of this natural community would be restored and 8,000 acres would be protected. There would be a net reduction in grassland acreage, but an increase in grassland value in the study area. The BDCP beneficial effects analysis for grassland, which was developed for Alternative 4 (BDCP Chapter 5, Section 5.4.11.2), indicates that 8,000 acres of grasslands would be protected in Conservation Zones 1, 2, 4, 5, 7, 8, and 11, and 2,000 acres of grassland would be restored. Grassland protection and restoration would improve connectivity among habitat areas in and adjacent to the Plan Area, improve genetic interchange among native species' populations, and contribute to the long-term conservation of grassland-associated covered species. The same conservation actions would be implemented for Alternative 9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would permanently remove 82 acres and temporarily remove 344 acres of grassland natural community. The permanent losses would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. The main locations affected and the types of grassland lost are listed below (see Terrestrial Biology Mapbook for location details).
    - Permanent and temporary losses of thin bands of ruderal herbaceous grasses and forbs at the canal construction site connecting Clifton Court Forebay with the export pipelines.
    - Permanent and temporary losses of thin bands of ruderal herbaceous grasses and forbs at the canal construction site that connects Clifton Court Forebay with Victoria Canal.
    - Permanent and temporary losses of thin bands of ruderal herbaceous grasses and forbs along Victoria Canal where access roads and a barge unloading facility would be constructed.
    - Permanent and temporary losses of thin bands of ruderal herbaceous grasses and forbs along the edges of Middle River between Victoria Canal and Mildred Island where access roads and dredging work areas would be established.
    - Permanent losses of rye grassland from the channel enlargement connecting the Sacramento River with the Meadows Slough.
    - Permanent and temporary losses of rye grassland from channel enlargement in the Meadows Slough east of the Sacramento River.
    - Permanent and temporary losses of ruderal herbaceous grasses and forbs at intake and fish screen construction sites at Delta Cross Channel junction with Sacramento River.
    - Permanent and temporary losses of thin bands of ruderal herbaceous grasses and forbs at these operable barrier construction sites (some with barge unloading facilities):
        - Connection Slough at its junction with Middle River.
        - Middle River just south of its junction with Victoria Canal.
        - Old River at its northern junction with the San Joaquin River.
        - Fishermans Cut at its junction with the San Joaquin River.
        - Three Mile Slough at its junction with the Sacramento River.

These losses would take place during the near-term construction period.

The construction activity associated with CM1 also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction of canals in and around the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. BDCP Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *CM2 Yolo Bypass Fisheries Enhancement*: Implementation of CM2 involves a number of construction activities within the Yolo and Sacramento Bypasses, including Fremont Weir and stilling basin improvements, Putah Creek realignment activities, Toe Drain/Tule Canal and Lisbon Weir modification and Sacramento Weir improvements. All of these activities could involve excavation and grading in grassland areas to improve passage of fish through the bypasses. Based on hypothetical construction footprints, a total of 388 acres could be permanently lost and another 239 acres could be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir where a large expanse of grassland is present, along the Toe Drain/Tule Canal, and along the west side channels. These grasslands are composed primarily of upland annual grassland and forbs. Some of this grassland removal along the side channels of the bypass could pose barriers to grassland species moving within the bypass. These losses would occur primarily in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Based on the use of hypothetical restoration footprints, implementation of CM4 would permanently inundate or remove 448 acres of grassland in the near-term and inundate or remove 1,122 acres of grassland by the end of the Plan timeframe. The losses would occur in a number of ROAs established for tidal restoration (see Figure 12-1). The largest losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Most of this grassland is ruderal herbaceous vegetation with low habitat value; some of the larger patches of grassland in the Cache Slough ROA are annual grassland with higher values.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would permanently remove 51 acres and temporarily remove 34 acres of grassland natural community. The construction-related losses would be considered a permanent removal of the habitats. These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7 (see Figure 12-1). The grassland in this area is primarily composed of narrow bands and small patches of ruderal herbaceous grasses and forbs. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years.

- *CM6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM7 Riparian Natural Community Restoration;* Riparian natural community restoration would occur in a variety of settings in the Plan Area, with an emphasis on improving connectivity of existing riparian areas and stream/river corridors, to benefit the movement and interchange of special-status and common species that use these areas. Large tracts would be restored in concert with floodplain restoration (CM5), while narrower bands would be developed as part of channel margin enhancement (CM6) and tidal marsh restoration (CM4). In the process of expanding woody riparian habitat, existing nonnative grassland would be removed. While specific locations for these restoration activities have not been fully developed, use of theoretical footprints for this activity indicate that up to 410 acres of grassland could be lost through the course of Alternative 9 implementation. A majority of this activity would occur in the South Delta and Cosumnes/Mokelumne ROAs (see Figure 12-1).
- *CM8 Grassland Natural Community Restoration*: The grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZs 1, 8, and 11, as proposed by BDCP Objective GNC1.1 (Figure 12-1), with a goal of improving habitat connectivity and increasing the diversity of grassland species (BDCP Objective GNC1.2). Some of the planned 2,000 acres of restoration would occur around existing populations of giant garter snake in the east Delta and the Yolo Bypass area.
- *CM11 Natural Communities Enhancement and Management:* Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the BDCP. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public's ability to participate in recreational activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known, so the analysis of this activity is programmatic. At the current level of planning, it is assumed that the trail system would be located entirely in grassland habitats and would include up to 50 acres of habitat loss.
- *CM18. Conservation Hatcheries:* The BDCP includes a proposal to design and construct a conservation hatchery to maintain populations of delta smelt and longfin smelt. The location of this facility is not yet firmly established, but for planning purposes it has been assumed that it would be constructed in the vicinity of Rio Vista and would be located in grassland habitat. The grassland in the Rio Vista area includes both California annual grassland and ruderal herbaceous grasses and forbs. The current estimate of the land needed for this facility is 35 acres.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

During the near-term timeframe (the first 10 years of BDCP implementation), Alternative 9 would affect the grassland natural community through CM1 construction losses (82 acres permanent and 344 acres temporary), CM2 construction losses (388 acres permanent and 239 acres temporary), CM11 recreational trail construction (13 acres permanent), CM18 fish hatchery construction (35 acres permanent), and CM7 riparian habitat restoration (4 acres permanent). These losses would occur at multiple locations, including canal, channel enlargement and operable barrier construction sites; adjacent to dredging operations along Middle River; in the northern Yolo Bypass; along the east and west channels within the Yolo Bypass; and at currently unspecified sites for hatchery and recreational trail construction and riparian restoration. Approximately 448 acres of the inundation and construction-related losses in habitat from CM4 would occur in the near-term. These tidal restoration-related losses would occur throughout the ROAs mapped in Figure 12-1.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see BDCP Chapter 3, *Conservation Strategy*). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses later in this chapter. The combination of restoring 1,140 acres (CM8) and protecting 2,000 acres (CM3) of grassland natural community during the first 10 years of BDCP implementation, and the commitment to restore temporarily affected grassland (583 acres) to its pre-project condition within 1 year of completing construction as required by *AMM10 Restoration of Temporarily Affected Natural Communities*, would offset this near-term loss, avoiding any loss in the value of this habitat for special-status species. The restoration of grassland would include protection in perpetuity, and the protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (CM3 and CM11). The typical project-level mitigation ratio (2:1 for protection) would indicate that 3,106 acres of protection would be needed to offset (i.e., mitigate) the 1,553 acres of near-term temporary and permanent loss. The combination of protection and restoration (2,000 acres of protection and 1,140 acres of restoration), along with the enhancement and management associated with CM3 and CM11 contained in the BDCP is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species. There would be no adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Implementation of Alternative 9 as a whole would result in approximately 3% losses of grassland natural community in the study area. These losses (2,138 acres of permanent and 617 acres of temporary loss) would be largely associated with construction of the water conveyance facilities (CM1), construction of Yolo Bypass fish improvements (CM2), inundation during tidal marsh restoration (CM4), and riparian habitat restoration (CM7). Inundation losses would occur through the course of BDCP restoration activities at various tidal restoration sites throughout the study area.

***NEPA Effects*:** By the end of the Plan timeframe, a total of 2,000 acres of this natural community would be restored (CM8) and 8,000 acres would be protected (CM3). The restoration would occur primarily in CZ 1, CZ 8, and CZ 11, in the Cache Slough, Suisun Marsh and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity. The 2,000 acres of restoration associated with CM8, and the restoration of temporarily affected grassland required by AMM10 (617 acres for Alternative 9) would not totally replace the grassland acres lost through the Plan timeframe (2,755 acres). There would be a permanent loss of 138 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 9 would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion:

Near-Term Timeframe

Alternative 9 would result in the loss of approximately 1,553 acres of grassland natural community in the near-term (a combination of the temporary and permanent losses listed in Table 12-9-11) due to construction of the water conveyance facilities (CM1), fish passage improvements (CM2), riparian habitat restoration (CM7), recreational trail development (CM11), fish hatchery construction (CM18), and inundation during tidal marsh restoration (CM4). The construction losses would occur at multiple canal and operable barrier construction sites, at channel enlargement sites, at dredging locations along Middle River and Victoria Canal, within the northern section of the Yolo Bypass, and at currently unspecified sites for hatchery and recreational trail construction and riparian habitat restoration. Inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across a 10-year near-term timeframe.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this chapter because grassland is not considered a special-status or sensitive natural community. Nonetheless, these losses would be offset by planned restoration of 1,140 acres and protection of 2,000 acres of grassland natural community scheduled for the first 10 years of Alternative 9 implementation, and restoration of temporarily affected grassland (583 acres for Alternative 9) as dictated by AMM10. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting near-term restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (2:1 for protection) would indicate that 3,106 acres of protection would be needed to offset (i.e., mitigate) the 1,553 acres of loss. The combination of two approaches (protection and restoration) contained in the BDCP conservation measures and avoidance and minimization measures is designed to avoid a temporal lag in the value of grassland habitat available to special-status species. The protection and restoration would be initiated at the beginning of Alternative 9 implementation to minimize any time lag in the availability of this habitat to special-status species.

Late Long-Term Timeframe

At the end of the Plan period, 2,755 acres of grassland natural community would be permanently or temporarily removed by conservation actions, 2,000 acres would be restored and 8,000 acres would be protected. Temporarily affected areas would also be restored (617 acres for Alternative 9). While there would be a net permanent reduction in the acreage of this natural community within the study area (total loss of 138 acres), there would be an increase in the value of grassland for special-status and common species in the study area through the combination of conservation actions (CM3 and CM8) and avoidance and minimization measures (AMM1, AMM2, AMM6, AMM7, and AMM10). Therefore, Alternative 9 would have a less-than-significant impact on this natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Two Alternative 9 conservation measures would modify the inundation/flooding regimes of both natural and man-made waterways in the study area. CM2, which is designed to improve fish passage and shallow flooded habitat for Delta fishes in the Yolo Bypass, would increase periodic inundation of grassland natural community at scattered locations, while CM5 would expose this community to additional flooding as channel margins are modified and levees are set back to improve fish habitat along some of the major rivers and waterways of the study area.

- *CM2 Yolo Bypass Fisheries Enhancement:* Operation of the Yolo Bypass under Alternative 9 would result in an increase in the frequency, magnitude and duration of inundation of 385–1,277 acres of grassland natural community. The methods used to estimate this inundation acreage are described in BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*. The area more frequently affected by inundation would vary with the flow volume that would pass through the newly constructed notch in the Fremont Weir. The 385-acre increase in inundation would occur at the 1,000 cfs flow regime, while the 1,277-acre increase would occur at the 4,000 cfs flow regime. Plan-related increases in flow through Fremont Weir would be expected in 30% of the years. The grassland community occurs throughout the bypass, including a large acreage just below Fremont Weir in the north end of the bypass, in stringers along the internal waterways of the bypass and in larger patches in the lower bypass. The anticipated change in management of flows in the Yolo Bypass includes more frequent releases in flows into the bypass from the Fremont and Sacramento Weirs, and in some years, later releases into the bypass in spring months (April and May). The modification of periodic inundation events would not adversely affect grassland habitats, as they have persisted under similar high flows and extended inundation periods. There is the potential for some change in grass species composition as a result of longer inundation periods. The effects of this inundation on wildlife and plant species are described in detail in later sections of this chapter.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration would result in an increase in the frequency and duration of inundation of 85 acres of grassland habitats (a combination of the temporary and permanent losses listed in Table 12-9-11). Specific locations for this restoration activity have not been identified, but they would likely be focused in the south Delta area, along the major rivers and Delta channels in CZ 7 (see Figure 12-1). The increase in periodic stream flooding events would not adversely affect the habitat values and functions of grassland natural community.

In summary, 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing two Alternative 9 conservation measures (CM2 and CM5).

NEPA Effects: The grasslands in the Yolo Bypass and along river floodplains in the south Delta are conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage and value of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would not constitute an adverse effect.

CEQA Conclusion: An estimated 899–1,791 acres of grassland natural community in the study area would be subjected to more frequent inundation as a result of implementing CM2 and CM5 under Alternative 9. The grassland natural community is conditioned to periodic inundation; therefore, periodic inundation would not result in a net permanent reduction in the acreage of this community in the study area. Increasing periodic inundation of grassland natural community in the Yolo Bypass and along south Delta waterways would have a less-than-significant impact on the community.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 9 are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the BDCP facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include the diversion of Sacramento River flows at two newly screened sites at Georgianna Slough and Delta Cross Channel in the north Delta, operation of multiple operable barriers in Delta waterways, and modified diversions from south Delta channels. These actions are associated with CM1 (see the impact discussion above for effects associated with CM2). The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (CM13), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and modified diversions from south Delta channels* Changes in releases from reservoirs upstream of the study area, modified diversion of Sacramento River flows at Georgianna Slough and Delta Cross Channel in the north Delta, modified diversions from south Delta channels (Operational Scenario G) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, modified diversions of Sacramento River flows at Georgianna Slough and Delta Cross Channel would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Modified diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair*. Periodic repair of access roads, water conveyance facilities and levees associated with the BDCP actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earth work adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management*. Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*CM11 Natural Communities Enhancement and Management)*. Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the BDCP to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.
- *Channel dredging*. Long-term operation of the Alternative 9 intakes at Georgianna Slough and Delta Cross Channel would include periodic dredging of sediments that might accumulate in front of intake screens. Periodic dredging would also be needed to maintain channel capacity in Middle River and Victoria Canal. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes and dredged channels is ruderal grasses and herbs with low habitat value. *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities* are part of the Plan and would require actions to avoid or minimize dredging effects on adjacent sensitive vegetation.
- *Habitat enhancement*. The BDCP includes a long-term management element for the natural communities within the Plan Area (CM11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and periodic facilities maintenance and dredging. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *CM8 Grassland Natural Community*

Restoration, or minimized by implementation of AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 9 would not result in a net permanent reduction in the grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 9 would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM3, AMM4, AMM5, AMM6, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *CM3 Natural Communities Protection and Restoration* and *CM11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *CM8 Grassland Natural Community Restoration* and protection actions associated with *CM3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the value of this natural community within the study area. Therefore, there would be a less-than-significant impact.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community includes approximately 19 acres of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1). While this community is within the BDCP Plan Area, none of the Alternative 9 conservation measures or covered actions is expected to affect it.

Cultivated Lands

Cultivated lands is the major land cover type in the study area (487,106 acres; see Table 12-1 in Section 12.1.2, *Land Cover Types*). The Delta, the Yolo Bypass and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 list special-status wildlife species supported by cultivated lands.

The effects of Alternative 9 on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species in this chapter also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses below, there is no separate analysis of this land cover type presented here. Table

14-8 in Chapter 14 provides a comparison of important farmland losses that would result from construction of CM1 water conveyance facilities for each alternative, and Table 14A-1 in Appendix 14A, *Individual Crop Effects as a Result of BDCP Water Conveyance Facility Construction,* provides a similar comparison for losses of individual crops. Table 12-ES-1 in this chapter's Summary of Effects identifies the total cultivated land loss for all project alternatives. For Alternative 9, the total loss (permanent and temporary) is estimated to be 55,091 acres. The majority of the permanent loss would be associated with habitat restoration activities, including Yolo Bypass fisheries enhancement (CM2; 629 acres), tidal marsh restoration (CM4; 39,565 acres), floodplain restoration (CM5; 2,087 acres), riparian natural community restoration (CM7; 960 acres), grassland restoration (CM8; 2,000 acres) and nontidal marsh restoration (CM10; 1,950 acres). Construction of the through-Delta water conveyance facilities (CM1) would permanently remove 350 acres of cultivated land.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized here as developed lands. Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities. Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap. There are approximately 90,660 acres of developed lands in the study area.

As with cultivated lands, no effort has been made to analyze the effects of BDCP covered actions on this land cover type. It is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value for vernal pool crustaceans are areas along the eastern boundary of Conservation Zone 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but which do not include topographic depressions that are characteristic of vernal pool crustacean habitat.

Construction and restoration associated with Alternative 9 conservation measures would result in permanent losses (see Table 12-9-12) and indirect conversions of vernal pool crustacean modeled habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit vernal pool crustaceans (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (Objective VPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)
- Protect one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-12. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	0	0	0	0	NA	NA
	Low-value	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18 [b]	High-value	0	0	0	0	0–4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0–4**	**0**
TOTAL IMPACTS		**201**	**372**	**0**	**0**	**0–4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 9 conservation measures would result in the direct, permanent loss of up to 372 acres modeled vernal pool crustacean habitat, all of which would be to low-value habitat and would all be based on the hypothetical footprints for tidal natural communities restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 135 acres of vernal pool crustacean habitat (89 acres of high-value habitat and 45 acres of low-value habitat) from the hypothetical footprints for tidal restoration (CM4). Tidal restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 9 would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool fairy shrimp (270 acres), and vernal pool tadpole shrimp (270 acres). The hypothetical tidal restoration (CM4) footprints in CZ 11 account for all of these effects. *AMM12*

Vernal Pool Crustaceans would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on the covered vernal pool crustaceans. As specified in *AMM12 Vernal Pool Crustaceans* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. *AMM12* would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. The term *wetted acre*s refers to an area that would be defined by the three parameter wetland delineation method used by USACE to determine the limits of a wetland, which involves an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration:* Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool crustacean habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low- value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool crustaceans as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Wildlife 2013). Helm (1998) notes that many vernal pool crustaceans can occur in degraded vernal pool habitats and artificial habitats. In CZs 2 and 4, there are several records of covered vernal pool crustaceans occurring outside of modeled habitat in areas that appear to be road side ditches. So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool crustaceans and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool crustacean habitat. In addition, tidal restoration could result in the indirect conversion of 136 acres of vernal pool crustacean habitat, which consist of 89 acres of high-value and 45 acres of low-value habitat. The hypothetical restoration footprints overlap with a CNDDB record for vernal pool fairy shrimp near the current edge of Suisun Marsh. Tidal natural community restoration under Alternative 9 would also result in impacts on critical habitat for Conservancy fairy shrimp (248 acres), vernal pool tadpole shrimp (270 acres), and vernal pool fairy shrimp (270 acres). *AMM12 Vernal Pool Crustaceans* would ensure that there would be no adverse modification of the primary constituent elements of critical habitat for these species.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool crustaceans (Table 12-9-12). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values over the term of the BDCP. Human presence for recreation activities could result in the injury or mortality of, and degreation of habitat for, vernal pool crustaceans through trampling pool edges, increased turbidity, unauthorized collection, and introduction of trash. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-9-13 was prepared to further analyze BDCP effects on vernal pool crustaceans using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, and *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of vernal pool crustacean habitat. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-9-13. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 9 (acres)

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 9 Impact[b]	CM1[c]	0	0	0	0
	CM4[d]	30.2	55.8	11.0	20.3
Total		**30.2**	**55.8**	**11.0**	**20.3**

[a] Because roughly half of the impacts would occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-9-12 has densities of wetted vernal pool crustacean habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] The temporary impacts from transmission line construction associated with CM1 would be zero because the commitment in AMM30, which calls for temporary transmission lines to avoid removal of alkali seasonal wetland and vernal pool wetted acres. This would lower CM1 impacts to 2.3 acres.

[d] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on vernal pool crustacean habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-9-12 lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans (see AMM12). As seen in Table 12-9-13, Alternative 9 would not meet the Plan's near-term biological goals and objectives for direct loss and indirect conversion unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. If impacts on wetted vernal pools from tidal restoration stay within the limit presented in Table 12-9-13, the near-term effects of tidal restoration would require up to 5 wetted acres of vernal pool restoration and up to 30 wetted acres of vernal pool protection (or 200 acres of vernal pool complex protection using the 15% density assumption).

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-9-13, Alternative 9 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to a late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

NEPA Effects: The near-term loss of vernal pool crustacean habitat under Alternative 9 would not be adverse under NEPA because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, the modification of vernal pool crustacean habitat and potential mortality of a special-status species resulting from Alternative 9 in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, management, and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management and enhancement would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the period of construction. Considering these commitments, losses and conversion of vernal pool crustacean habitat under Alternative 9 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-9-12 lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool crustacean habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on covered vernal pool crustaceans (see AMM12). As seen in Table 12-9-13, Alternative 9 would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. If impacts on wetted vernal pools from tidal restoration stay within the near-term effect limit presented in Table 12-9-13, the near-term effects of tidal restoration would require up to 5 wetted acres of vernal pool restoration and up to 30 wetted acres of vernal pool protection (or 200 acres of vernal pool complex protection using the 15% density assumption).

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on vernal pool crustacean habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-9-13, Alternative 9 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage. The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)
- Protecting one currently unprotected occurrence of conservancy fairy shrimp (Objective VPC1.1)

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration and protection of alkali seasonal wetlands that could overlap with the species model, could result in the restoration of 51 acres and the protection of 608 acres of modeled habitat for vernal pool crustaceans.

The effects on vernal pool crustacean habitat from Alternative 9 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pool crustacean habitat and to habitat protection, restoration, and management and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period any construction activity would be occurring. Considering these commitments, Alternative 9 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 9 would have a less-than-significant impact on vernal pool crustaceans.

Impact BIO-33: Indirect Effects of Plan Implementation on Vernal Pool Crustaceans

Construction and maintenance activities associated with restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–6, 10, and 12, which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** Restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. The indirect effects of Alternative 9 on vernal pool crustacean habitat would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the construction phase. The indirect impacts of Alternative 9 would be less than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass under *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled vernal pool crustacean habitat (Table 12-9-12). There would be no periodic effects resulting from *CM5 Seasonally Inundated Floodplain Restoration*.

NEPA Effects: BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect vernal pool crustaceans occupying areas ranging from 0 acres of habitat during most notch flows to an estimated 4 acres during a notch flow of 6,000 cubic feet per second (cfs). BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus not be adverse under NEPA.

CEQA Conclusion: Alternative 9 would periodically inundate at most 4 acres of vernal pool crustacean habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of vernal pool crustacean habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on vernal pool crustaceans and would thus result in less-than-significant impacts on the species.

Valley Elderberry Longhorn Beetle

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation measures, on the valley elderberry longhorn beetle. That habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (channels and grasslands within 200 feet of channels). Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-9-14. The majority of the losses would take place over an extended period of time as the restoration conservation measures are being implemented. In addition, an estimated 15 elderberry shrubs could be impacted by the Alternative 9 conveyance alignment (CM1). Full implementation of the Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit valley elderberry longhorn beetle (BDCP Chapter 3, *Conservation Strategy*).

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines for the species (Objective VELB1.1)
- Site elderberry longhorn beetle habitat restoration adjacent to occupied habitat (Objective VELB1.2)
- Restore 5,000 acres of valley/foothill riparian (Objective VFRNC1.1, associated with CM7)
- Protect 750 acres of valley/foothill riparian (Objective VFRNC1.2, associated with CM3)
- Maintain or increase the abundance and distribution of rare or uncommon vegetation alliances, such as *Sambuca nigra* (blue elderberry stands) alliance (Objective VFRNC3.1, associated with CM7 and CM11)

As explained below, with the restoration or protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-14. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Riparian	61	61	248	248	NA	NA
	Nonriparian	75	75	280	280	NA	NA
Total Impacts CM1		**136**	**136**	**528**	**528**	**NA**	**NA**
CM2–CM18	Riparian	381	678	76	111	44–80	266
	Nonriparian	142	311	94	108	103–244	287
Total Impacts CM2–CM18		**523**	**989**	**170**	**219**	**161–325**	**553**
TOTAL IMPACTS		**659**	**1,125**	**698**	**747**	**161–325**	**553**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 9 conservation measures would result in the permanent and temporary loss combined of up to 1,872 acres of modeled valley elderberry longhorn beetle habitat (1,098 acres of riparian habitat and 774 acres of nonriparian habitat), and an estimated 15 elderberry shrubs from CM1, which represent potential habitat for the species (Table 12-9-14). Due to the limitation of the habitat suitability model, all of these effects are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Timely implementation of the near-term habitat protection and restoration contained in the Plan and implementation of AMMs committed to in the Plan would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities would result in the permanent and temporary combined loss of approximately 664 acres of modeled valley elderberry longhorn beetle habitat, composed of 309 acres of riparian habitat and 355 acres of nonriparian habitat (Table 12-9-14). In addition, an estimated 15 shrubs could be removed as a result of conveyance facility construction. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the channel enlargement and operable barrier construction. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 528 acres of modeled valley elderberry longhorn beetle habitat (248 acres riparian and 280 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, temporary access roads, and staging areas.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 295 acres of modeled valley elderberry longhorn beetle habitat, composed of 159 acres of riparian habitat and 136 acres of nonriparian habitat. Approximately 125 acres of permanent impacts (83 acres of riparian and 41 acres of nonriparian) would mostly occur at the north end of the Yolo Bypass from Fremont Weir improvements. The 170 acres of temporary impacts (76 acres of riparian and 94 acres of nonriparian) would mostly be from work on the Freemont Weir, the Sacramento Weir, and levees along the Bypass. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee modification, and removal of riprap and other protections from channel banks.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 8131 acres of modeled valley elderberry longhorn beetle habitat, composed of 552 acres of riparian and 260 acres of nonriparian habitat. The majority of these impacts would be associated with tidal restoration in the Delta and only 42 acres of these impacts (all nonriparian) would be from tidal restoration in Suisun Marsh. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 101 acres of valley elderberry longhorn beetle habitat, composed of 78 acres of riparian and 23 acres of nonriparian. Approximately half of these impacts (52 acres) would be permanent impacts from levee construction and the other half (49 acres) would be temporary impacts associated with the levee construction. There is one CNDDB record of valley elderberry longhorn beetle occurring in CZ 7 just wet of Middle River on Union Island. This record and other elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, levee removal and modification, and removal of riprap and other protections from channel banks.
- *CM11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of BDCP protected habitats for covered species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs discussed below.
- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs described below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Alternative 9 would result in permanent and temporary impacts on 1,357 acres of modeled habitat (766 acres of riparian and 591 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 309 acres of riparian and 355 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 766 acres (60%) of impacts on riparian habitat. Based on the DHCCP survey data of the conveyance planning area, an estimated 15 elderberry shrubs would be impacted by conveyance construction in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified as habitat for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 309 acres of the riparian habitat should be restored/created and 309 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses. In addition, BDCP Objectives VELB 1.1 and 1.2 call for implementing the USFWS conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of CM7 *Riparian Natural Community Restoration*. CM7 *Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection proposed in the near-term Plan goals are just slightly less (16 acres less) than what would be considered the typical mitigation requirements for riparian natural community impacts. However, the Plan's commitments in BDCP Objectives VELB 1.1 and 1.2 would satisfy typical mitigation requirements for valley elderberry longhorn beetle and thus the Plan would sufficiently reduce the effects from CM1 and other near-term conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,872 acres of modeled valley elderberry longhorn beetle habitat (1,098 acres of riparian habitat and 774 acres of nonriparian habitat)during the term of the Plan (5% of the modeled habitat in the study area).

The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. Other factors relevant to effects on valley elderberry longhorn beetle include:

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat during the near-term evaluation period because most of the affected riparian vegetation would be removed during the near-term timeframe, while large quantities of riparian habitat would not be restored until the early and late long-term timeframes. Effects on valley elderberry longhorn beetle of this temporal loss of riparian vegetation are expected to be minimal because much of the riparian habitat in the Plan Area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation would be moved to conservation areas in the Plan Area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the Plan Area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the conservation measures or other covered activities that would result in temporary effects on natural communities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

NEPA Effects**:** The near-term loss of valley elderberry longhorn beetle habitat under Alternative 9 would not be adverse because the BDCP has committed to restoring and protecting an acreage that exceeds the typical mitigation ratios described above, in addition to avoiding impacts on shrubs and transplanting those that can't be avoided. In the absence of other conservation actions, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 9 in the late long-term would represent an adverse effect. However, with habitat protection and restoration associated with CM7, guided by species-specific goals and objectives and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the construction period, the effects of Alternative 9 as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 9 would result in permanent and temporary impacts on 1,357 acres of modeled habitat (766 acres of riparian and 591 acres of nonriparian) for valley elderberry longhorn beetle in the study area in the near-term. These impacts would result from the construction of the water conveyance facilities (CM1, 309 acres of riparian and 355 acres of nonriparian), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] and tidal restoration [CM4], 693 acres of modeled habitat). The other conservation measures account for 457 of the 766 acres (60%) of impacts on riparian habitat. Based on the DHCCP survey data of the conveyance planning area, an estimated 15 elderberry shrubs would be impacted by conveyance construction in the near-term by CM1 (see Section 12.3.2.3 for a discussion on the methods used to make this estimate).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for valley elderberry longhorn beetle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection for riparian habitat. Using these typical ratios would indicate that 309 acres of the riparian habitat should be restored/created and 309 acres of existing riparian should be protected to mitigate the CM1 losses of valley elderberry longhorn beetle habitat. The near-term effects of other conservation actions would require 457 acres of riparian restoration and 457 acres of riparian protection using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres of riparian and restoring 800 acres of riparian habitat in the Plan Area. These conservation actions would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on valley elderberry longhorn beetle. In addition, BDCP Objectives VELB 1.1 and 1.2, which call for implementing the USFWS conservation guidelines for valley elderberry longhorn beetle (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle. These objectives would be met through the implementation of *CM7 Riparian Natural Community Restoration*. CM7 specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection proposed in the near-term Plan goals are just slightly less (16 acres less) than what would be considered the typical mitigation requirements for riparian natural community impacts. However, the Plan's commitments in BDCP Objectives VELB 1.1 and 1.2 would satisfy typical mitigation requirements for valley elderberry longhorn beetle and thus the Plan would sufficiently reduce the effects from CM1 and other near-term conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM15 Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities; the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The acres of protection proposed in the near-term Plan goals are just slightly less (16 acres less) than what would be considered the typical mitigation requirements for riparian natural community impacts. However, the Plan's commitments in BDCP Objectives VELB 1.1 and 1.2 would satisfy typical mitigation requirements for valley elderberry longhorn beetle and thus the Plan would sufficiently reduce the effects from CM1 and other near-term conservation measures. These commitments, implemented together with the AMMs, are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,872 acres of modeled valley elderberry longhorn beetle habitat (1,098 acres of riparian habitat and 774 acres of nonriparian habitat)during the term of the Plan (5% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. These losses would not fragment any known populations of valley elderberry longhorn beetle. The Plan includes a commitment to protect 750 acres of riparian habitat and restoring/creating 5,000 acres of riparian habitat in the Plan Area. According to Objective VELB1.2, the restoration of elderberry longhorn beetle habitat would occur adjacent to occupied habitat, which would provide connectivity between occupied and restored habitats and improve the species' ability to disperse within and outside the Plan Area. The BDCP also includes a number of AMM1–AMM6, AMM10, and AMM15) directed at minimizing or avoiding potential impacts on valley elderberry longhorn beetle. The large acreages of conservation would adequately compensate for the modeled habitats lost to construction and restoration activities.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as other actions that overlap with the nonriparian portions of the species model, could result in the restoration of 4,857 acres (riparian) and the protection of 2,363 acres (729 acres of riparian and 1,634 acres of nonriparian channels and grassland) of modeled habitat for valley elderberry longhorn beetle.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 9 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on valley elderberry longhorn beetle over the term of the BDCP. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis (see Section 12.3.2.3 for a discussion on the methods used to make this estimate) estimates that approximately 103 shrubs could be indirectly affected by conveyance facilities construction (CM1). Restoration activities could result in excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15, which would be in effect throughout the Plan's construction phase.

NEPA Effects: The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 9 conservation actions would not have an adverse effect on valley elderberry longhorn beetle.

CEQA Conclusion: Ground-disturbing activities, stockpiling of soils, and the potential release of dust and hazardous substances would accompany construction of the water conveyance facilities. An estimated 103 shrubs could be indirectly affected by conveyance facilities construction (CM1). In addition, ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks could indirectly affected elderberry shrubs that occur within 100 feet of these restoration activities. With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 9 construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse indirect effects on valley elderberry longhorn beetle in that the Plan would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 161 to 325 acres of modeled valley elderberry longhorn beetle habitat (Table 12-9-14).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 553 acres of modeled valley elderberry longhorn beetle habitat (Table 12-9-14).

It is unknown at this time how much of the modeled habitat that would be inundated as a result of CM2 and CM5 actually contains elderberry shrubs. Elderberry shrubs have been found to be intolerant of long periods of inundation and there is evidence that they die very quickly after even short periods of flooding (River Partners 2008). During monitoring of a restoration project at the San Joaquin River National Wildlife Refuge, River Partners found that nearly all (99% to 100%) of the 4-year-old elderberry shrubs in restoration plots died after 15–17 weeks of inundation, and

River Partners noted in general that the shrubs died very quickly after even short periods of flooding (River Partners 2008). Talley et al (2006) in their report assisting the USFWS 5-year review of the species, note that elderberry shrubs respond negatively to saturated soil conditions and that they can only tolerate temporary root crown inundation. Therefore, in the areas that would be periodically inundated by the implementation of CM2 it is likely that there are few, if any, mature shrubs in these areas because under current conditions they would be inundated in about 50% of all years for approximately 7 weeks. The areas affected by CM5 are not currently inundated and thus elderberry shrubs could present in these areas.

The periodic effects on modeled habitat for valley elderberry longhorn beetle associated with implementing Alternative 9 could adversely affect valley elderberry longhorn beetle habitat (elderberry shrubs) and make modeled habitat there unsuitable for future elderberry establishment. Based on the information presented above, the current conditions in those areas that would be periodically inundated in Yolo Bypass (CM2) are not likely very suitable for elderberry shrubs and thus CM2 would likely have minimal effects, if any, on the species. The modeled habitat that would be periodically inundated from the implementation of CM5 could result in adverse effects on valley elderberry longhorn beetle.

***NEPA Effects*:** Periodic effects of the inundation of valley elderberry longhorn beetle habitat as a result of implementing Alternative 9 conservation actions would not be adverse under NEPA when taking into consideration CM7 habitat protection and restoration. This habitat protection and restoration would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, and AMM15, which would be in place throughout the time period that periodic effects would occur.

***CEQA Conclusion*:** Alternative 9 (CM2 and CM5) would have periodic impacts on modeled valley elderberry longhorn beetle habitat. The periodic inundation of between 161 and 325 acres (CM2) and 553 acres (CM5) of modeled habitat could result in the death of elderberry shrubs that may occur there and thus potentially impact valley elderberry longhorn beetle. The Plan includes the restoration of 5,000 acres of riparian habitat (Objective VFRNC1.1) and the protection of 750 acres riparian habitat (VFRNC1.2) would include areas for elderberry restoration and protection. The BDCP also includes AMM1–AMM6, AMM10, and AMM15, which would minimize and avoid impacts on valley elderberry longhorn beetle prior to Yolo Bypass fisheries enhancement and floodplain restoration activities. AMM15, which includes measure for following the USFWS conservation guidelines for valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999a), would be used to identify shrubs for transplanting to conservation areas that otherwise could be adversely affected by periodic inundation in Yolo Bypass and floodplain restoration areas. These conservation actions would compensate for the periodic impacts on valley elderberry longhorn beetle.

Considering these protection and restoration provisions and avoidance and minimization measures, implementation of Alternative 9 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, periodic effects of inundation resulting from Alternative 9 would have a less-than-significant impact on valley elderberry longhorn beetle.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on other, noncovered vernal pool invertebrates that are not covered by the plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle).

Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but do not include topographic depressions that are characteristic of vernal pools.

Construction and restoration associated with Alternative 9 conservation measures would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-9-15 and indirect conversions of vernal pool habitat. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP that would benefit nonlisted vernal pool invertebrates (BDCP Chapter 3, *Conservation Strategy*).

- Protect 600 acres of vernal pool complex in CZ 1, CZ 8, or CZ 11, primarily in core vernal pool recovery areas (ObjectiveVPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration [10 wetted acres])(Objective VPNC1.2, associated with CM9).
- Increase size and connectivity of protected vernal pool complexes in plan area and increase connectivity with complexes outside the Plan Area (ObjectiveVPNC1.3)
- Protect the range of inundation characteristics of vernal pools in the Plan Area (Objective VPNC1.4)
- Maintain and enhance vernal pool complexes to provide appropriate inundation (ponding) for supporting and sustaining vernal pool species (Objective VPNC2.1)

As explained below, with the restoration or protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would be adverse for NEPA purposes and would be significant for CEQA purposes.

Table 12-9-15. Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	0	0	0	0	NA	NA
	Low-value	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**		**NA**	**NA**
CM2–CM18[e]	High-value	0	0	0	0	0-4	0
	Low-value	201	372	0	0	0	0
Total Impacts CM2–CM18		**201**	**372**	**0**	**0**	**0-4**	**0**
TOTAL IMPACTS		**201**	**372**	**0**	**0**	**0-4**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

[e] Includes indirect conversion impacts

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 9 conservation measures would result in the direct, permanent loss of up to 372 acres of low-value vernal pool habitat from tidal habitat restoration (CM4). In addition, the conservation measures could result in the indirect conversion due to hydrologic changes of an additional 135 acres of vernal pool habitat (89 acres of high-value habitat and 45 acres of low-value habitat) from tidal restoration (CM4). Tidal restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute a possible conversion of the habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place and to restoration hypothetical footprints. Habitat enhancement and management activities (CM11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected and restoration projects designed to minimize or avoid effects on vernal pools and alkali seasonal wetlands. As specified in the BDCP, the BDCP Implementation Office would ensure that tidal restoration projects and other covered activities would be designed such that no more than a total of

10 wetted acres of vernal pool habitat are directly affected and that no more than 20 wetted acres of vernal pool habitat are indirectly affected by BDCP covered activities (AMM12). The term *wetted acres* refers to an area that would be defined by the three parameter wetland delineation method used by USACE to determine the limits of a wetland, which includes an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration:* Tidal natural communities restoration would result in the permanent loss of approximately 372 acres of low-value vernal pool habitat, which consists of degraded vernal pool complex. The BDCP describes degraded vernal pool complex as areas of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. The actual density of vernal pools or other aquatic features in these areas is unknown, but a 2012 review of Google Earth imagery found that these habitats appear to generally have low densities. However, areas mapped as degraded vernal pool complex may still provide habitat for vernal pool species as evidenced by records of vernal pool fairy shrimp, vernal pool tadpole shrimp, and California linderiella occurring in degraded vernal pool complex in CZ 4 (California Department of Fish and Wildlife 2013). So though degraded vernal pool complexes may not represent botanically diverse vernal pools they still can provide habitat for vernal pool invertebrates and thus the loss of 372 acres of degraded vernal pool complex may result in the loss of occupied vernal pool invertebrate habitat. In addition, tidal restoration could result in the indirect conversion of 135 acres of vernal pool habitat, which consist of 89 acres of high-value and 45 acres of low-value habitat. No records of nonlisted vernal pool invertebrates would be directly impacted by conservation actions.

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, restoration/creation of vernal pools to achieve no net loss and the protection of 600 acres of vernal pool complex would benefit vernal pool invertebrates (Table 12-9-15). A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included. Table 12-9-16 was prepared to further analyze BDCP effects on nonlisted vernal pool invertebrates using wetted acres of nonlisted vernal pool invertebrate habitat in order to compare to the effects of this alternative with the effect limits established in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*, and AMM12, which are measured in wetted acres of vernal pool species habitat. Based on an informal evaluation of aerial photographs of the Plan Area it is likely that the actual densities within the Plan Area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-9-16. Estimated Effects on Wetted Nonlisted Vernal Pool Invertebrate Habitat under Alternative 9 (acres)

		Direct Loss		Indirect Conversion	
		Near-Term	Late Long-Term	Near-Term	Late Long-Term
BDCP Impact Limit[a]		5	10	10	20
Alternative 9 Impact [b]	CM1[c]	0	0	0	0
	CM4[d]	30.2	55.8	11.0	20.3
Total		**30.2**	**55.8**	**11.0**	**20.3**

[a] Because roughly half of the impacts would occur in the near–term, it is assumed that the impact limit in the near-term would be 5 wetted acres for direct loss and 10 acres for indirect.

[b] These acreages were generated by assuming that the modeled habitat identified in Table 12-9-15 has densities of wetted vernal pool species habitat at 15%. The direct effects numbers include permanent and temporary impacts.

[c] The temporary impacts from transmission line construction associated with CM1 would be zero because the commitment in AMM30, which calls for temporary transmission lines to avoid removal of alkali seasonal wetland and vernal pool wetted acres. This would lower CM1 impacts to 2.3 acres.

[d] These impacts are based on the hypothetical restoration footprints and would likely be lower based on the BDCP's commitment to minimize and avoid effects on nonlisted vernal pool invertebrate habitat as much as practicable. The values for near-term indirect effects were assumed to be slightly more than half of what the late long-term value would be.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-9-16 above lists the impacts on nonlisted vernal pool invertebrate habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools (see AMM12). As seen in Table 12-9-16, Alternative 9 would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pool species habitat at a 2:1 ratio. If impacts on wetted vernal pools from tidal restoration stay within the near-term effect limit presented in Table 12-9-16, the near-term effects of tidal restoration would require up to 5 acres of vernal pool restoration and up to 30 wetted acres of vernal pool protection (or 200 acres of vernal pool complex protection using the 15% density assumption).

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrate habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities, AMM30 Transmission Line Design and Alignment Guidelines,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, although developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect conversion effects on vernal pools by the late long-term (see Objective VPNC1.2 and AMM12). As seen in Table 12-9-16, Alternative 9 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage (Objective VPNC1.2). The protection and restoration would be achieved using the criteria presented above as well as by the following other specific biological goals and objectives.

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3).
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4).

NEPA Effects: The near-term loss of vernal pool habitat under Alternative 9 would not be adverse under NEPA because the BDCP has committed to avoiding and minimizing effects from tidal restoration and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. In the absence of other conservation actions, he potential modification of vernal pool habitat and potential mortality of special-status species resulting from Alternative 9 in the late long-term would represent an adverse effect. However, the BDCP has committed to impact limits for vernal pool habitat and to habitat protection, restoration, management and enhancement associated with CM3, CM9, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the time period of construction. Considering these commitments, losses and conversions of nonlisted vernal pool invertebrates habitat under Alternative 9 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Table 12-9-15 lists the impacts on nonlisted vernal pool invertebrate habitat that is based on the natural community mapping done within the study area. The impacts from tidal natural communities restoration (CM4) are based on hypothetical footprints and do not reflect actual impacts on vernal pool habitat considering the BDCP's commitment to design restoration projects to minimize or avoid effects on vernal pools (see AMM12). As seen in Table 12-9-16, Alternative 9 would not meet the Plan's near-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that they do not exceed these impact limits.

Typical NEPA and CEQA project-level mitigation ratios for vernal pools affected by CM1 would be 1:1 for restoration and 2:1 for protection. Typically, indirect impacts are mitigated by protecting vernal pools at a 2:1 ratio. If impacts on wetted vernal pools from tidal restoration stay within the near-term effect limit presented in Table 12-9-16, the near-term effects of tidal restoration would require up to 5 acres of vernal pool restoration and up to 30 wetted acres of vernal pool protection (or 200 acres of vernal pool complex protection using the 15% density assumption).

The BDCP has committed to near-term goal of protecting 400 acres of vernal pool complex (see Table 3-4 in Chapter 3, *Description of Alternatives*) by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. The BDCP has also committed to restoring/creating vernal pools such that there is no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).

- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The species-specific biological goals and objectives would also inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects on nonlisted vernal pool invertebrates.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities,* and *Alignment Guidelines,* and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The natural community restoration and protection activities are expected to be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts on constitute adequate mitigation for CEQA purposes. These commitments, implemented together with the AMMs and biological goals and objectives, are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The BDCP states that covered activities would not result in more than 10 wetted acres of direct loss and no more than 20 wetted acres of indirect effects on vernal pools by the long-term term (see Objective VPNC1.2 and AMM12). As seen in Table 12-9-16, Alternative 9 would not meet the Plan's late long-term biological goals and objectives for direct and indirect effects unless near-term tidal restoration projects are designed to ensure that that they do not exceed these impact limits.

The Plan has committed to late long-term goal of protecting 600 acres of vernal pool complex in either Conservation Zones 1, 8, or 11, primarily in core vernal pool recovery areas (Objective VPNC1.1) by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage. The protection and restoration would be achieved using the criteria presented above as well as by following the other specific biological goals and objectives, which include:

- Increasing the size and connectivity of protected vernal pool complexes (Objective VPNC1.3)
- Protecting the range of inundation characteristics that are currently represented by vernal pool throughout the Plan Area (Objective VPNC1.4)

The effects on nonlisted pool invertebrate species habitat from Alternative 9 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the BDCP has committed to impact limits for vernal pools and alkali seasonal wetlands and to habitat protection, restoration, and management and enhancement associated with CM3, CM9, and CM11. These conservation activities would be guided by species-specific goals and objectives, and AMM1–AMM6, AMM10, AMM12, and AMM37, which would be in place throughout the time period any construction activity would be occurring. Considering these commitments, Alternative 9 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 9 would have a less-than-significant impact on nonlisted vernal pool invertebrates.

Impact BIO-39: Indirect Effects of Plan Implementation on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential effects would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the Plan's construction phase.

***NEPA Effects*:** Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the Plan's construction phase. Nonlisted vernal pool invertebrates and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebays could result in the inadvertent discharge of sediments and hazardous materials into nonlisted vernal pool invertebrate habitat that occurs along the southern and western boundaries of the forebays. These potential effects would be avoided and minimized through AMM1–AMM6, which would be in effect throughout the term of the Plan. The indirect effects of plan implementation under Alternative 9 would not be adverse.

***CEQA Conclusion*:** Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the Plan's construction phase. The indirect impacts of Alternative 9 would be less than significant.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 0 to 4 acres of modeled habitat for nonlisted vernal pool invertebrates (Table 12-9-15). There would be no periodic effects resulting from *CM5 Seasonally Inundated Floodplain Restoration*

***NEPA Effects*:** BDCP Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants*, describes the methods used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect nonlisted vernal pool invertebrates occupying areas ranging from 0 acres of habitat during most notch flows, to an estimated 4 acres during a notch flow of 6,000 cfs. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus not be adverse under NEPA.

***CEQA Conclusion*:** Alternative 9 would periodically inundate at most 4 acres of nonlisted vernal pool invertebrates' habitat during the maximum flows over the Fremont Weir. The periodic inundation is not anticipated to result in a conversion of nonlisted vernal pool invertebrates' habitat into different wetland habitat. BDCP-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, because Fremont Weir is expected to overtop the remaining 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the BDCP-related inundation area already inundates in the bypass. Yolo Bypass flooding is expected to have a minimal effect on nonlisted vernal pool invertebrates and would thus result in less-than-significant impacts on the species.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes the inland dune scrub at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 9 would not likely affect Sacramento and Antioch Dunes anthicid beetles. The channel work and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance construction would not affect inland dune scrub at Antioch Dunes NWR. No dredge spoil areas that could be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 9 operable barriers and areas of channel modifications on Google Earth imagery did not reveal any sandbars in the channels or along the channel margins. These portions of the Delta have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars and flows there are slow enough that sand deposits are unlikely.

Implementation of BDCP restoration based conservation measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the Plan Area is at Antioch Dunes, which would not be impacted by the Alternative 9 conservation measures. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of BDCP restoration actions, and other covered activities could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the Plan Area; however the extent of these habitats in the Plan Area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Over the term of the BDCP, Alternative 9 would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 9 objectives would generally increase opportunities for the formation of sandbars in the Plan Area.

- Restore 10,000 acres of seasonally inundated floodplain (Objective L2.11, associated with CM5).
- Enhance 20 miles of channel margin habitat (Objective L2.12, associated with CM6),
- Restore 5,000 acres of riparian habitat, with at least 3,000 acres occurring on restored seasonally inundated floodplain. (VFRNC1.1, associated with CM7).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins and in floodplains, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins and floodplains would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-17. Changes in Sacramento and Antioch Dunes Anthicid Beetles' Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 9 conservation measures could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur along to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of Google Earth imagery of the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery of the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the Plan Area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Conservation measures that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal habitat restoration (CM4), floodplain restoration (CM5), and channel margin enhancement (CM6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The West Delta ROA has been identified in the BDCP (BDCP Chapter 3, *Conservation Strategy*, Section 3.4.4) as providing opportunities for creating subtidal aquatic and tidal marsh habitats. The methods and techniques identified in the BDCP that may be used for tidal restoration include the recontouring of lands so that they have elevations suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.

- *CM5 Seasonally Inundated Floodplain Restoration*: Seasonally inundated floodplain restoration could impact areas with sandbars that were identified in a review of aerial photographs. The sandbars identified along the San Joaquin River and Paradise Cut are within the conceptual corridors (Corridors 1a, 1b, 2a, and 4) identified in Figure 3.4-20 of the BDCP. There are four CNDDB records for Sacramento anthicid beetle in the conceptual corridor along the San Joaquin River (California Department of Fish and Wildlife 2013). Floodplain restoration actions in these conceptual corridors could impact potential habitat for both these species and occupied habitat of Sacramento anthicid beetle.

- *CM6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 20 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The BDCP could result in substantial affects to Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which is being considered for tidal restoration (CM4), or within three of the conceptual corridors being considered for floodplain restoration (CM5). Furthermore, all seven of the records for Sacramento anthicid beetle within the study area fall within areas being considered for restoration (CM4 and CM5), which represent over half of the extant records for this species range wide (7 of 13), and the only extant record for Antioch Dunes anthicid beetle, which represent one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected by restoration if these areas are chosen as restoration projects. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. CM5, CM6, and CM7 would generally contribute to the formation of sandbar habitat in the Plan Area. These measures would improve shoreline conditions by creating benches along levees (CM6), creating shallow margin and floodplain habitat (CM5), and increasing shoreline vegetation (CM7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form. Other factors relevant to effects on Sacramento and Antioch Dunes anthicid beetle include:

- The actual extent of suitable and occupied habitat for these species in the plan is unknown.
- The sandbar habitat occupied by Sacramento anthicid beetle along the San Joaquin River would likely not be directly impacted where floodplain restoration occurs because the physical disturbance would be to adjacent levees and agricultural areas. Though these actions would change hydrologic conditions that could overtime remove the existing sandbars, the expanded floodplain would create conditions suitable for the formation of new and possibly larger sandbars.
- Floodplain restoration would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

NEPA Effects: The potential impacts on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 9 as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, with implementation of restoration associated with CM5, CM6, and CM7, which would be phased throughout the time period when the impacts would be occurring, the effects of Alternative 9 as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion: Alternative 9 would impact Sacramento and Antioch Dunes anthicid beetles' habitat and could impact seven occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, over the term of the BDCP, implementation of conservation components would likely benefit Sacramento and Antioch Dunes anthicid beetles. BDCP conservation components, particularly conservation measures CM5, CM6, and CM7, would generally contribute to the formation of sandbar habitat in the Plan Area. Floodplain restoration (CM5) would be phased over a period of 30 years so that not all sandbar habitat within these areas would be affected at once. Furthermore, as floodplain restoration is being implemented new sandbar habitat would likely be forming prior and/or concurrent with future floodplain restoration projects that may affect sandbar habitat on the San Joaquin River and/or Paradise Cut.

Considering that floodplain (CM5), channel margin enhancement (CM6), and riparian restoration (CM7) would contribute to the replacement of and possible expansion of sandbar habitat in the Delta and be phased throughout the time period when the impacts would be occurring, the implementation of Alternative 9 as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than-significant impact on Sacramento and Antioch Dunes anthicid beetles.

Delta Green Ground Beetle

This section describes the effects of Alternative 9 on delta green ground beetle. Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 9 would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 9 could affect delta green ground beetle through the protection of grasslands and vernal pool complex (CM3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions and recreational trail construction (CM11) in these areas. In addition, tidal natural communities restoration (CM4) and vernal pool and alkali seasonal wetland complex restoration (CM9) could result in potential impacts on delta green ground beetle and its habitat. Full implementation of Alternative 9 would likely result in beneficial effects on delta green ground beetle through the following conservation actions.

- Protect 2,000 acres of grassland in CZ 1 (Objective GNC1.1, associated with CM3).
- Protect 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1, associated with CM3).
- Restore up to 67 acres of vernal pool complex in CZs 1, 8, and/or 11 (Objective VPNC1.2, associated with CM9).

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-9-18. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	0	0	0	0	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	0	0	0	0	0	0
TOTAL IMPACTS	0	0	0	0	0	0

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 9 conservation measures could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Conservation measures that could affect delta green ground beetle are tidal natural communities habitat restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and habitat enhancement and management activities (CM11) in CZ 1. CZ 1 is the only portion of the Plan Area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; U.S. Fish and Wildlife Service 2009a). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *CM4 Tidal Natural Communities Restoration:* Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. CM4 identifies 5,000 acres of freshwater tidal natural communities restoration in the Cache Slough ROA and Lindsey Slough and Calhoun Cut have been identified as areas suitable for restoration. Lindsey Slough is just east of Jepson Prairie and Calhoun Cut, which is off of Lindsey Slough (see Figure 12-1), goes into the general Jepson Prairie area and is adjacent to areas of potential habitat for delta green ground beetle. The tidal restoration methods and techniques identified in CM4 (see BDCP Chapter 3, Section 3.4.4.3.3) includes excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affect delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species. No CNDDB records for delta green ground beetle are intersected by the hypothetical tidal restoration footprints being used by the BDCP.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle. However, if these activities do take place in suitable habitat, then disturbances could result in direct mortality of the species. Nevertheless, restoration ultimately would expand habitat available to the species.
- *CM11 Natural Communities Enhancement and Management*: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 1 and a portion of the 600 acres of protection and possibly some of the up to 10 wetted acres of vernal pool restoration could also occur in CZ 1. Potential effects from CM11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland and vernal pool complex management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of CM11 would result in impacts on 15.5 acres of grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The protection of 2,000 acres of grassland in CZ 1 (CM3) and the protection of 600 acres of vernal pool complex and up 10 wetted acres of vernal pool complex restoration, some of which could occur in CZ 1 (CM3 and CM9) could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. The management of these grasslands and vernal pool complexes according to *CM11 Natural Communities Enhancement and Management* and the construction of recreational trails in CZ 1 has a potential to affect this species. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Direct mortality and/or the affects to delta green ground beetle habitat would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce this effect.

CEQA Conclusion: The implementation of grassland and vernal pool complex protection (CM3), tidal natural communities restoration (CM4), vernal pool and alkali seasonal wetland complex restoration (CM9), and recreational trail construction and subsequent enhancement and management actions (CM11) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from CM11 could include direct mortality to larvae and adults resulting from the implementation of recreation trail construction in 15.5 acres of grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and therefore result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42 would reduce these potential impacts on a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areas in the area of Jepson Prairie, BDCP proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and non-cultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.
- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing covered activities in these areas will be avoided, which for the Plan Area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing covered activities will occur in areas identified as occupied by delta green ground beetle.
- Based on the results of the habitat evaluations and surveys, site-specific restoration and management plans will be developed so that they don’t conflict with the recovery goals for delta green ground beetle in the USFWS’s 2005 Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

This section describes the effects of Alternative 9 on callippe silverspot butterfly. Suitable habitats are typically in areas influenced by coastal fog with hilltops that support the specie’s host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldeneaster, coast buckwheat, mourning bride, and California buckeye. The construction, and operations and maintenance of the water conveyance facilities under Alternative 9 would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *CM3 Natural Communities Protection and Restoration* and the subsequent implementation of *CM11 Natural Communities Enhancement and Management,* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the Plan Area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Though CZ 11 has been identified as potential area for grassland restoration in *CM8 Grassland Natural Community Restoration,* the primary goal there is to restore small patches of grassland to connect to Jepson Prairie and/or the restoration of upland grasses adjacent to tidal brackish emergent wetland in Suisun Marsh, both of which would not be areas suitable for Callippe silverspot butterfly. The full implementation of Alternative 9 would protect up to 2,000 acres of grassland in CZ 11 (Objective GNC1.1, associated with CM3), some of which may contain habitat for Callippe silverspot butterfly. Any potential effects on callippe silverspot would be avoided and minimized through the implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43 would reduce the effects under NEPA and reduce the impacts on less-than significant under CEQA.

Table 12-9-19. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Permanent		Temporary		Periodic[d]	
	NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	0	0	0	0	NA	NA
	0	0	0	0	NA	NA
Total Impacts CM1	**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	0	0	0	0	0	0
	0	0	0	0	0	0
Total Impacts CM2–CM18	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS	**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 9 conservation measures could result in the conversion of habitat for and direct mortality of callippe silverspot butterfly. Only one conservation measure was identified as potentially affecting callippe silverspot butterfly, *CM11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *CM3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

CM11 Natural Communities Enhancement and Management: As described in *CM3 Natural Communities Protection and Restoration*, up to 2,000 acres of grasslands would be protected in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of 2,000 acres of grassland within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. The management of these grasslands according to CM11 Natural Communities Enhancement and Management has potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *CM3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *CM11 Natural Communities Enhancement and Management* has affect this species. Potential impacts from CM11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults resulting from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, CM11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, which could result in direct and indirect effects on larval host plants and nectar plants. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would therefore result in significant impact on the species under CEQA. However, over the term of BDCP callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and thus reduce the potential impact to a less-than-significant level.

Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, BDCP proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.
- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Construction and restoration associated with Alternative 9 conservation measures would result in permanent losses of California red-legged frog modeled habitat as indicated in Table 12-9-20. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP to benefit the California red-legged frog (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11, CM13, and CM20).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).

- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3)
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-20. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Aquatic	0	0	0	0	NA	NA
	Upland	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	8	24	0	0	0	0
Total Impacts CM2–CM18		**8**	**24**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**8**	**24**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 9 conservation measure CM11 would result in the permanent loss of 24 acres of modeled upland habitat for t California red-legged frog. There are no California red-legged frog occurrences that overlap with the Plan footprint. Construction activities associated recreational facilities, including operation of construction equipment, could result in temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 3, Section 3.4.11, an estimated 24 acres of upland cover and dispersal habitat for the California red-legged frog would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation-related effects on California red-legged frog are expected to be minimal.

  Activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs discussed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog.

- Critical habitat: Several conservation measures would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Conservation actions to protect and enhance grassland habitat for covered species, including California red-legged frog, in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation conservation actions and implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 would reduce these effects.

- Injury and direct mortality: Construction activities associated with t vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 9 would permanently remove 8 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of recreational facilities (CM11).

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 2:1 for protection of grassland habitats. Using these ratios would indicate that 16 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM14 California Red-Legged Frog, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS, *Avoidance and Minimization Measures*.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic 7,766 acres of upland habitat for California red-legged frog.

Alternative 9 as a whole would result in the permanent loss of 24 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total upland habitat in the study area). Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

NEPA Effects: In the near-term, the loss of California red-legged frog habitat under Alternative 9 would be not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 9 as a whole on California red-legged frog would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 9 would permanently remove 8 acres of upland terrestrial cover habitat for California red-legged frog. The effects would result from construction of recreational facilities (CM11).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for California's red-legged frog in Chapter 3 of the BDCP would be 2:1 for protection of grassland habitats. Using these ratios would indicate that 16 acres of grassland should be protected for California red-legged frog to mitigate the near-term losses.

The BDCP has committed to near-term protection of up to 2,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8, west of Byron Highway, would benefit California red-legged frog by providing habitat in the portion of the Plan Area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features within the grasslands would be protected to provide aquatic habitat for this species, and surrounding grassland would provide dispersal and aestivation habitat which would compensate for the loss of 1 acre of aquatic habitat. In addition, aquatic features in grasslands would be maintained and enhanced to provide suitable inundation depth and duration to support breeding habitat for covered amphibians (Objective GNC2.5).

These conservation actions would occur in the same timeframe as the construction losses, thereby avoiding adverse effects of habitat loss on California red-legged frog. These Plan objectives represent performance standards for considering the effectiveness of CM3 protection and restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California red-legged frog satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM14, and AMM37. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 on California red-legged frog would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 16 acres of upland communities protected.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 159 acres of aquatic 7,766 acres of upland habitat for California red-legged frog. Alternative 9 as a whole would result in the permanent loss of 24 acres of upland habitat for California red-legged frog for the term of the plan (less than 1% of the total upland habitat in the study area). Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of tidal freshwater emergent wetland, grassland, valley/foothill riparian, and vernal pool complex that could overlap with the species model, would result in the restoration of 16 acres of aquatic and 351 acres of upland modeled habitat for California red-legged frog. In addition, protection of managed wetland, grassland, valley/foothill riparian, and vernal pool complex could overlap with the species model and would result in the protection of 3 acres of aquatic and 1,047 acres of upland California red-legged frog modeled habitat.

In the absence of other conservation actions, the losses of California red-legged frog aquatic and upland habitat associated with Alternative 9 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM14, and AMM37, the effects of Alternative 9 would have a less-than-significant impact on California red-legged frog.

Impact BIO-45: Indirect Effects of Plan Implementation on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted in this area (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 9 would avoid the potential for substantial adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on California red-legged frog.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance, as well as construction-related noise and visual disturbances including aritifical nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, construction, operation, and maintenance under Alternative 9 would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 9 would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While conservation measures implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 9 is expected to result in the temporary, permanent, and periodic removal of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-9-21). Potential aquatic habitat for this species would not be affected. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by BDCP actions. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP to benefit the California tiger salamander (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining alkali seasonal wetland species (Objective ASWNC2.1, associated with CM3 and CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).

- Restore vernal pool complex in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration, assuming that all anticipated impacts [10 wetted acres] occur and that the restored vernal pool complex has 15% density of vernal pools) (Objective VPNC1.2, associated with CM3 and CM9).
- Increase the size and connectivity of protected vernal pool complex within the Plan Area and increase connectivity with protected vernal pool complex adjacent to the Plan Area (Objective VPNC1.3, associated with CM3).
- Protect the range of inundation characteristics that are currently represented by vernal pools throughout the Plan Area (Objective VPNC1.4, associated with CM3).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and CM8).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Objective GNC2.5, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-21. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic	0	0	0	0	NA	NA
	Upland	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Aquatic	0	0	0	0	0	0
	Upland	292	634	0	0	191–639	0
Total Impacts CM2–CM18		**292**	**634**	**0**	**0**	**191–639**	**0**
TOTAL IMPACTS		**292**	**634**	**0**	**0**	**191–639**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 9 conservation measures would result in the permanent loss of up to 634 acres of modeled upland habitat for California tiger salamander (Table 12-9-21). There are no California tiger salamander occurrences that overlap with the Plan footprint. Conservation measures that would result in these losses are Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), construction of recreational facilities, and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California tiger salamander habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent removal of approximately 42 acres of terrestrial cover and aestivation habitat for the California tiger salamander in the late long-term. The modeled habitat in the Yolo Bypass is of low potential for California tiger salamander: There have been no observations of California tiger salamander in this area based on the results of a number of surveys for vernal pool invertebrates and plants, and the bypass lacks vernal pool complexes with large, deep pools or large grassland areas with stock ponds and similar aquatic features that hold water long enough to provide potential breeding habitat for this species.

- *CM4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of approximately 517 acres of terrestrial cover and aestivation habitat in the study area in the late long-term. Tidal restoration in the Cache Slough area would result in habitat loss along the edges of Lindsey Slough and Duck Slough, and adjacent to cultivated land along the eastern edge of a block of modeled habitat. The modeled aquatic breeding habitat nearby the hypothetical tidal restoration footprint is of relatively high value, consisting of vernal pool complex along Lindsey Slough within the Jepson Prairie area in and near open space. The Jepson Prairie area includes numerous California tiger salamander CNDDB recorded occurrences and overlaps with Critical Habitat Unit 2, Jepson Prairie Unit, for this species. However, the hypothetical tidal restoration footprint does not overlap with critical habitat or recorded occurrences in this area. The tidal restoration at Lindsey Slough would occur along the northeastern edge of the Jepson Prairie block of habitat and would not contribute to fragmentation. Because the estimates of habitat loss resulting from tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because of the ability to select sites that minimize effects on California tiger salamander.

- *CM11 Natural Communities Enhancement and Management*: Based on the recreation assumptions described in BDCP Chapter 3, Section 3.4.11, an estimated 40 acres of terrestrial cover and aestivation habitat for the California tiger salamander would be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California tiger salamander are expected to be minimal.

  Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values over the term of the BDCP. At least 1,000 acres of grassland habitat and some unknown acres of vernal pool complex habitat in CZ 8 are expected to benefit the California tiger salamander through protection of existing upland cover and dispersal habitat from potential loss or degradation that otherwise could happen with future changes in existing land use. Activities associated with natural communities enhancement and management over the term of the BDCP in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- *CM18 Conservation Hatcheries*: This activity could result in the permanent removal of approximately 35 acres of terrestrial cover and aestivation habitat for California tiger salamander in the Yolo Bypass area (CZ 2). The specifications and operations of this facility have not been developed, although the facility is expected to be constructed near Rio Vista on cultivated lands in low-value habitat for the species.

- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by BDCP tidal habitat restoration actions. Tidal habitat would be restored approximately 2 miles east of SR 113, with some restoration taking place along the Barker and Lindsey Slough channels west to approximately SR 113 and a small amount (0.4 acre) taking place along the Lindsey Slough Channel west of SR 113 into Critical Habitat Unit 2.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.
- Injury and direct mortality: Construction activities associated with the water conveyance facilities, vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 9 would permanently remove approximately 292 acres of upland terrestrial cover habitat for California tiger salamander. There would be no effect on aquatic habitat. The effects would result from Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

The typical NEPA project-level mitigation ratio of 2:1 for protected grassland habitats would indicate that 584 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes.

In addition, the plan contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander*, and *AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander. Alternative 9 as a whole would result in the permanent loss of, and temporary effects on 634 acres of upland habitat for California tiger salamander for the term of the plan (less than 2% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

NEPA Effects: In the near-term, the loss of California tiger salamander habitat under Alternative 9 would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of California tiger salamander upland habitat associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, the effects of Alternative 9 as a whole on California tiger salamander would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant.

Alternative 9 would permanently remove approximately 292 acres of upland terrestrial cover habitat for California tiger salamander. There would be no effect on aquatic habitat. The effects would result from Yolo Bypass improvements (CM2, 42 acres), tidal habitat restoration (CM4, 203 acres), construction of recreational facilities (CM11, 12 acres), and construction of conservation hatcheries (CM18, 35 acres).

The typical CEQA project-level mitigation ratio of 2:1 for protected grassland habitats would indicate that 584 acres of grassland should be protected in the near-term for California tiger salamander to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 1,140 acres of upland habitat (Objective GNC1.2) and 40 acres of aquatic habitat and to protection of at least 520 acres of aquatic habitat (Objective ASWNC1.1 and Objective VPNC1.1) and 2,000 acres of upland habitat (Objective GNC1.1). The landscape-scale goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes.

In addition, the plan contains commitments to implement AMM1–AMM6, AMM10, AMM13, and AMM37, which include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. These commitments are more than sufficient to support the conclusion that the near-term impacts of Alternative 9 on California tiger salamander would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 584 acres of upland communities protected.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander. Alternative 9 as a whole would result in the permanent loss of, and temporary effects on 634 acres of upland habitat for California tiger salamander for the term of the plan (less than 2% of the total upland habitat in the study area). The location of these losses is described above in the discussions of CM2, CM4, CM11, and CM18.

The BDCP has committed to long-term protection of 8,000 acres grassland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Protection of at least 1,000 acres of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas (Objective GNC1.1). Consistent with Objective GNC1.3, ponds and other aquatic features in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders (Objective GNC2.5). Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in CM11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This objective would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the Plan Area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the restoration of 88 acres of aquatic and 598 acres of upland modeled habitat for California tiger salamander. In addition, protection of alkali seasonal wetland complex, vernal pool complex, and grassland that could overlap with the species model, would result in the protection of 750 acres of aquatic and 5,000 acres of upland California tiger salamander modeled habitat.

In the absence of other conservation actions, the losses of California tiger salamander upland habitat associated with Alternative 9 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction phase, the impacts of Alternative 9 as a whole on California tiger salamander would not be significant under CEQA.

Impact BIO-47: Indirect Effects of Plan Implementation on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conservation component construction and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical night lighting at a worksite, over the term of the BDCP. Most of the areas indirectly affected are associated with the construction of Byron Forebay and its borrow and spoil areas in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

***NEPA Effects*:** Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 9 would avoid or minimize the potential for substantial adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances including aritifical night lighting at a worksite could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 9, the BDCP would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 9 would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement is the only conservation measure expected to result in periodic inundation of California tiger salamander habitat. Periodic inundation of Yolo Bypass could affect from an estimated 191 acres of terrestrial habitat during a notch flow of 1,000 cfs, to an estimated 639 acres of terrestrial habitat during a notch flow of 4,000 cfs in CZ 1 (Table 12-9-21). This effect would only occur during an estimated maximum of 30% of years and in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal terrestrial habitat for the California tiger salamander under existing conditions. No aquatic breeding habitat would be affected (Table 12-9-21). The modeled habitat in the Yolo Bypass in the vicinity of terrestrial habitat is of low value in that there are no California tiger salamander records in this area and the bypass lacks vernal pool complexes with large, deep pools, or large grassland areas with stock ponds and similar aquatic features that provide the habitat of highest value for this species. Therefore, the terrestrial habitat to be affected has a small likelihood of supporting California tiger salamanders, and Yolo Bypass operations are expected to have a minimal effect on the species, if any.

***NEPA Effects*:** The effects of periodic inundation from Alternative 9 would not have an adverse effect on California tiger salamander.

***CEQA Conclusion*:** Flooding of the Yolo Bypass from Fremont Weir operations would periodically increase the frequency and duration of inundation of 191–639 acres of terrestrial habitat for California tiger salamander. Because this area is considered low-value habitat and there are no California tiger salamander records in the area, and because of the lack of suitable breeding habitat in this area, the effects of periodic inundation of California tiger salamander habitat from Alternative 9 would have a less-than-significant impact**.**

Giant Garter Snake

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on the giant garter snake. The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic (except in Suisun Marsh), tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities within 200 feet of modeled aquatic habitat features (primarily grassland and cropland). The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (Hansen pers. comm. in Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh-White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-9-22. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP to benefit the giant garter snake (BDCP Chapter 3, *Conservation Strategy*).

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).

- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3 and CM11).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Of the at least 1,200 acres of nontidal marsh created under (Objective NFEW/NPANC1.1), create 600 acres of aquatic habitat giant garter snake aquatic habitat that is connected to the 1,500 acres of rice land or equivalent-value habitat described below in Objective GGS1.4 (Objective GGS1.1, associated with CM3, CM4, and CM10).
- Of the 8,000 acres of grassland protected under Objective GNC1.1 and 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland giant garter snake habitat adjacent to the at least 600 acres of nontidal perennial habitat being restored and/or created in CZ 4 and/or CZ 5 (Objective GGS1.2, associated with CM3 and CM8).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands (Objectives GGS1.1 and GGS1.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS1.3, associated with CM3).
- Create connections from the White Slough population to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting, restoring, and/or creating at least 1,500 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 1,500 acres may consist of tidal freshwater emergent wetland and may overlap with the 24,000 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria described in CM4. Up to 500 (33%) of the 1,500 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS1.4, associated with CM3 and CM4).
- Of the at least 1,200 acres of nontidal marsh created under Objective NFEW/NPANC1.1, create 600 acres of connected aquatic giant garter snake habitat outside the Yolo Bypass in CZ 2 (Objective GGS2.1, associated with CM3 and CM10).
- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres restored under Objective GNC1.2, create or protect 200 acres of high-value upland habitat adjacent to the

600 acres of nontidal marsh created in CZ 2 outside of Yolo Bypass (GGS2.1) (Objective GGS2.2, associated with CM3 and CM8).

- To expand upon and buffer the newly restored/created nontidal perennial habitat in CZ 2, protect 700 acres of cultivated lands, with 500 acres consisting of rice land and the remainder consisting of compatible cultivated land that can support giant garter snakes. The cultivated lands may be a subset of lands protected for the cultivated lands natural community and other covered species (Objective GGS2.3, associated with CM3).
- Protect giant garter snakes on created nontidal marsh (Objective GGS2.1) and created or protected adjacent uplands (Objective GGS2.2) from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads, and establishing giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Objective GGS2.4, associated with CM3).
- Protect, restore, and/or create 2,740 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 1, CZ 2, CZ 4, or CZ 5. Up to 500 acres may consist of tidal freshwater emergent wetland and may overlap with the at least 5,000 acres of tidally restored freshwater emergent wetland in the Cache Slough ROA if this portion meets giant garter snake habitat criteria specified in CM4. Up to 1,700 acres may consist of rice fields in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*. Any remaining acreage would consist of rice land or equivalent-value habitat outside the Yolo Bypass. Up to 915 (33%) of the 2,740 acres may consist of suitable uplands adjacent to protected or restored aquatic habitat (Objective GGS3.1, associated with CM3, CM4, and CM10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-22. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 9[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Aquatic (acres)	210	210	266	266	NA	NA
	Upland (acres)	154	154	627	627	NA	NA
	Aquatic (miles)	20	20	20	20	NA	NA
Total Impacts CM1 (acres)		**364**	**364**	**893**	**893**	**NA**	**NA**
CM2–CM18	Aquatic (acres)	179	498	15	38	NA	NA
	Upland (acres)	1,467	2,443	219	261	582–1,402	331
	Aquatic (miles)	49	189	9	10	NA	NA
Total Impacts CM2–CM18 (acres)		**1,646**	**2,941**	**234**	**299**	**582–1,402**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**2,010**	**3,305**	**1,127**	**1,192**	**582–1,402**	**331**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.
[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts on upland habitats only are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 9 conservation measures would result in the permanent and temporary loss combined of up to 1,012 acres of modeled aquatic habitat (tidal and nontidal combined), up to 3,485 acres of modeled upland habitat, and up to 239 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-9-22). There is one giant garter snake occurrence that overlaps with the Plan footprint. Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), and construction of a conservation fish hatchery (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities would result in the permanent loss of approximately 364 acres of modeled giant garter snake habitat, composed of 210 acres of aquatic habitat and 154 acres of upland habitat (Table 12-9-22). The 364 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 23 acres of high-, 96 acres of moderate-, and 35 acres of low-value habitat. In addition, approximately 20 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 266 acres of giant garter snake aquatic habitat and up to 627 acres of adjacent upland habitat in areas near construction in CZ 5 and CZ 6 (see Table 12-9-22 and Terrestrial Biology Map Book). In addition, approximately 20 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction.

  Most of the habitat that would be lost is located in the central Delta, in CZ 6, and CZ 8 south of Bacon Island. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Water facilities construction and operation is expected to have low to moderate potential for adverse effects on giant garter snake aquatic habitat on Mandeville Island because it is not located near or between subpopulations identified in the draft recovery plan However, giant garter snake occurrences were reported in 1992 in the vicinity of Snodgrass Slough just northeast of Locke in CZ 5 and in 1996 on the north side of Columbia Cut on the south side of Medford Island in CZ 6. There would be no effect from construction of CM1 near the CZ 6 occurrence. However, there would be both permanent (channel enlargement and connections) and temporary impacts on modeled giant garter snake habitat in Meadow Slough which is hydrologically connected to Snodgrass Slough and is less than 0.4 miles away from the giant garter snake occurrence.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 83 acres of aquatic habitat and 458 acres of upland habitat for the giant garter snake in the late long-term. The upland habitat that would be removed is composed of 336 acres of high-value, 121 acres of moderate-value, and 1 acre of low-value habitat. Approximately 14 miles (less than 1% of total miles in Plan Area) of channels providing giant garter snake habitat for movements would be removed as a result of Freemont Weir/Yolo Bypass Improvements. Most of this habitat removal would occur at the north end of the Yolo Bypass, near Fremont Weir. Construction is expected to have adverse effects on giant garter snake aquatic habitat in the Yolo Bypass area because it is near the Yolo Basin/Willow Slough subpopulation.

  In addition to habitat loss from construction related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 395 acres of aquatic habitat and 2,123 acres of upland habitat for the giant garter snake to tidal marsh in the late long-term. The upland habitat affected by tidal inundation includes 594 acres of high-value, 1,375 acres of moderate-value, and 154 acres of low-value habitat. In addition, approximately 138 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration. Most of the effects of tidal natural communities restoration would occur in the Cache Slough and Yolo Bypass areas (CZ 1 and CZ 2). This aquatic habitat is of low to moderate value: it is in and near Category 1 open space but is not near any giant garter snake occurrences and is not near or between giant garter snake subpopulations identified in the draft recovery plan. Tidal natural communities restoration is expected to have little to no adverse effects on giant garter snake aquatic or upland habitat in the Cache Slough ROA. There are no giant garter snake occurrences in this area, which is already tidally influenced so it has limited value for the giant garter snake (giant garter snakes may occur in tidally muted areas but are not likely to use aquatic areas with a strong tidal influence).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 89 acres of upland habitat for giant garter snake. The upland habitat to be removed is composed of 51 acres of moderate-value and 38 acres of low-value upland habitat. Approximately 2 miles of channels providing giant garter snake movement habitat would be removed as a result of floodplain restoration. Seasonally inundated floodplain restoration is expected to have little to no adverse effects on giant garter snake aquatic habitat because the site is not located near or between giant garter snake subpopulations identified in the draft recovery plan. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on giant garter snake habitat.

- *CM11 Natural Communities Enhancement and Management*: Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, *AMM37 Recreation* requires setbacks for trails in giant garter snake habitat. With this measure in place, recreation-related effects on giant garter snake are expected to be minimal.

  A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- *CM18 Conservation Hatcheries*: Construction for conservation hatcheries could result in the permanent removal of 35 acres of moderate-value upland habitat for the giant garter snake in the Yolo Bypass area (CZ 2).

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the two subpopulations: Yolo Basin/Willow Slough [CZ 2] and the Coldani Marsh-White Slough [CZ 4 and CZ 5]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction, as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 9 would permanently and temporarily remove 670 acres of aquatic habitat and 2,467 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 476 acres of aquatic and 781 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 98 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 670 acres of aquatic habitat should be restored, 670 acres of aquatic habitat should be protected, and 4,934 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least

500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 670 acres of aquatic communities restored, 670 acres of aquatic communities protected, and 4,934 acres of upland communities protected.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM16 Giant Garter Snake,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,012 acres of aquatic habitat and 3,485 acres of upland habitat for giant garter snake during the term of the plan (3% of the total aquatic habitat and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake under Objective GGS3.1 to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11*)* would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

NEPA Effects: In the near-term, the loss of giant garter snake habitat under Alternative 9 would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of giant garter snake associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and AMM1–AMM7, AMM10, AMM16, and AMM37, the effects of Alternative 9 as a whole on giant garter snake would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 9 would permanently and temporarily remove 670 acres of aquatic habitat and 2,467 acres of upland habitat for giant garter snake in the study area during the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 476 acres of aquatic and 781 acres of upland habitat), Yolo Bypass fisheries improvements (CM2, 83 acres of aquatic and 458 acres of upland habitat), from tidal restoration (CM4, 111 acres of aquatic and 1,193 acres of upland habitat), and conservation hatcheries (CM18, 35 acres of upland habitat). The aquatic habitat losses would occur in tidal and nontidal wetland natural communities and rice fields. The upland habitat losses would occur in cropland and grassland communities. In addition, approximately 98 miles of irrigation and drainage channels providing giant garter snake movement habitat would be removed. The habitat model likely overestimates the relative value of irrigation and drainage canals in the vicinity of White Slough and south due to its proximity to records that likely represent single displaced snakes, not viable populations.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for giant garter snake in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 670 acres of aquatic habitat should be restored, 670 acres of aquatic habitat should be protected, and 4,934 acres of upland habitat should be protected for giant garter snake to mitigate the near-term losses.

The BDCP has committed to near-term restoration of up to 8,100 acres of aquatic habitat and up to 1,140 acres of upland habitat, and to protection of at least 16,900 acres of upland habitat. Lands to be protected and restored in the near-term specifically for the giant garter snake total 3,900 acres (400 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 2,400 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 900 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, 900 of the 2,400 acres of rice land or habitat of equivalent value would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2) (Objective GGS3.1). An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees,

trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3).

These habitat protection and restoration measures would benefit the giant garter snake and the plan's species-specific biological goals and objectives would inform the near-term protection and restoration efforts. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known populations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be not be adverse under CEQA, because the number of acres required to meet the typical ratios described above would be only 670 acres of aquatic communities restored, 670 acres of aquatic communities protected, and 4,934 acres of upland communities protected.

The Plan also includes commitments to implement AMM1-AMM7, AMM10, AMM16, and AMM37. All of these AMMs include elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 31,281 acres of aquatic and 53,285 acres of upland habitat for giant garter snake. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,012 acres of aquatic habitat and 3,485 acres of upland habitat for giant garter snake during the term of the plan (3% of the total aquatic habitat and 6% of the total upland habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The BDCP has committed to protecting 8,000 acres of grassland and 48,625 acres of cultivated lands in the study area, and restoring 25,100 acres tidal and nontidal wetlands and 2,000 acres of grasslands in the study area. Lands to be protected and restored specifically for the giant garter snake total 6,540 acres (1,200 acres nontidal marsh, 400 acres of grassland, 700 acres of cultivated lands including at least 500 acres of rice) in CZ 2, and acres of rice or habitat of equivalent value in CZ 2, CZ 4, and CZ 5. Additionally, 4,240 acres of rice or habitat equivalent (1,500 acres under Objective GGS1.4 and 2,740 acres under Objective GGS3.1) would be restored or protected to create connections from the Coldani Marsh/White Slough population to other areas in the giant garter snake historical range. Additionally, the 2,740 acres of rice land or habitat of equivalent value under Objective GGS3.1 would be protected and restored for the giant garter snake to achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2). In addition to the 6,540 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration of 4,430 acres and protection of 3,733 acres of garter snake habitat.

Protection and management of cultivated lands (CM3 and CM11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Assuming the length of canals and ditches providing giant garter snake movement habitat on the protected cultivated lands is proportional to the modeled habitat on cultivated lands in the Plan Area, the 48,625 acres of protected cultivated lands would support approximately 281 miles of movement habitat for the giant garter snake (2,784 miles multiplied by 0.101 [48,625 acres protected of 481,909 acres in Plan Area]).

Giant garter snake habitat would be restored and protected specifically, to conserve and expand the Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the Plan Area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the Plan Area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal freshwater emergent wetland, alkali seasonal wetland, grassland, and vernal pool complex that could overlap with the species model, would result in the restoration of 3,450 acres of aquatic and 980 acres of upland modeled habitat for giant garter snake. In addition, protection of cultivated land, grassland, alkali seasonal wetland, and vernal pool complex could overlap with the species model and would result in the protection of 1,547 acres of aquatic and 2,185 acres of upland giant garter snake modeled habitat.

The BDCP also includes a number of AMM1–AMM7, AMM10, AMM16, and AMM37 directed at minimizing or avoiding potential impacts on adjacent habitats during construction and operation of the conservation measures. Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, implementation of Alternative 9 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of giant garter snake habitat and potential mortality of snakes would have a less-than-significant impact on giant garter snake under CEQA.

Impact BIO-50: Indirect Effects of Plan Implementation on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect throughout the plan's construction phase.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills occurring and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under CM1 were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and floodplains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with avoidance and minimization measures and adaptive management and monitoring, *CM12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities and floodplains.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the Central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Effects on giant garter snake from increased methylmercury exposures is more likely in the Yolo Basin, where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008). Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). Planned floodplain restoration activities in the Yolo Basin are expected to seasonally increase methylmercury production, although production would be minimized by *CM12 Methylmercury Mitigation*. Further, the periods of production and increased exposure to methylmercury do not overlap with giant garter snake seasonal activity periods. This seasonal trend should help to decrease risk to the giant garter snake, although snakes could prey on individuals that have been exposed to methylmercury during the previous season.

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *CM12 Methylmercury Management* include provisions for project-specific Mercury Management Plans.

Along with avoidance and minimization measures and adaptive management and monitoring, CM12 is expected to reduce the effects of methylmercury resulting from BDCP natural communities and floodplain restoration on giant garter snake.

***NEPA Effects*:** Implementation of the AMMs listed above as part of implementing Alternative 9 would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on giant garter snake.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37 as part of Alternative 9 construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Alternative 9 would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the indirect effects of Alternative 9 would have a less-than-significant impact on giant garter snakes.

Giant garter snake could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes, and, therefore, would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 9 would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***NEPA Effects*:** Alternative 9 would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***CEQA Conclusion*:** Alternative 9 would have a less-than-significant impact on connectivity between giant garter snakes in the study area.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement: The proposed changes in Fremont Weir operations would occur intermittently from as early as mid-November through as late as mid-May. The core operations would occur during the winter/spring period, which corresponds mostly with the giant garter snake's inactive season. During this time, snakes are overwintering underground. Giant garter snakes that occur in the bypass during the active season could overwinter in the bypass during the inactive season: these snakes may be vulnerable to inundation of the bypass and could be drowned or displaced from overwintering sites. However, most typically, Fremont Weir "notch" operations would occur on the shoulders of time periods in which the Sacramento River rises enough for Fremont Weir to overtop passively, without the proposed project. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation that would have occurred Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Duration of inundation may also be an important factor determining effects on overwintering giant garter snakes. Radiotelemetry studies have revealed giant garter snakes surviving in burrows that had been inundated for 2 to 3 weeks, but it is unknown what duration of inundation the snakes can survive while overwintering in their burrows.

Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants,* provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect giant garter snakes overwintering in upland areas ranging from an estimated 582 acres of upland habitat during notch flow of 1,000 cfs to an estimated 1,402 acres during a 4,000-cfs notch flow. The 4,000-cfs notch flow would affect an estimated 888 acres of high-value habitat and 514 acres of moderate-value habitat.

As noted above under the discussion of habitat loss from construction-related activities in Yolo Bypass, late season flooding in the bypass may result in loss of rice habitat (considered aquatic habitat for giant garter snake) by precluding the preparation and planting of a maximum of 1,662 acres of rice fields (BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass*). This analysis concludes that the estimated loss of rice is 1,662 acres which was considered to occur late long-term. Restoration and protection of 2,740 acres of rice land or habitat of equivalent value for the giant garter snake would achieve a 1:1 ratio of habitat conserved to habitat affected (habitat affected includes uplands periodically flooded and rice lost due to late season flooding in Yolo Bypass as a result of CM2).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 606 acres of upland habitat for the giant garter snake in the south Delta (CZ 7). The upland habitat to be inundated contains 432 acres of moderate-value and 174 acres of low-value habitat. The area between existing levees would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The restored floodplain would include a range of elevations from low-lying areas that flood frequently (e.g., every 1 to 2 years) to high-elevation areas that flood infrequently (e.g., every 10 years or more). There are no records of giant garter snakes in the vicinity of where floodplain restoration is expected to occur.

Based on modeled habitat for the giant garter snake, the study area supports approximately 53,285 acres of upland habitat for giant garter snake. Approximately 2,008 acres of giant garter snake upland habitat (4% of total upland habitat in the study area) may be adversely affected by periodic flooding as a consequence of floodplain restoration and the operation of the Fremont Weir.

NEPA Effects: Periodic effects on upland habitat for giant garter snake associated with implementing Alternative 9 are not expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, as it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, Alternative 9 would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass from CM2 and creation of seasonally inundated floodplain in various parts of the study area (CM5) would periodically affect a total of approximately 2,008 acres of upland habitat for giant garter snake. The inundation could affect overwintering snakes. Project-associated inundation of areas that would not otherwise have been inundated is expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. Currently, in more than half of all years, an area greater than the area that would be inundated as a result of covered activities is already inundated during the snake's inactive season (Kirkland pers. comm.). Therefore, increased inundation in the Yolo Bypass as a result of BDCP is expected to have a minimal effect on the Yolo Basin/Willow Slough subpopulation. Therefore, implementing Alternative 9, including AMM1–AMM7, AMM10, and AMM16, would not be expected to result in substantial adverse effects on giant garter snakes, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Periodic effects of inundation under Alternative 9 would have a less-than-significant impact on the species.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, Section 2A.30, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-9-23. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP to benefit the western pond turtle (BDCP Chapter 3, *Conservation Strategy*).

- Protect or restore 142,200 acres of high-value natural communities and covered species habitats (Objective L1.1, associated with CM3).
- Restore and protect 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise. Minimum restoration targets for tidal natural communities in each ROA are 7,000 acres in Suisun Marsh ROA, 5,000 acres in Cache Slough ROA, 1,500 acres in Cosumnes/Mokelumne ROA, 2,100 acres in West Delta ROA, and 5,000 acres in South Delta ROA (Objective L1.3, associated with CM2, CM3, and CM4).

- Within the 65,000 acres of tidal natural communities and transitional uplands (Objective L1.3), include sufficient transitional uplands along the fringes of restored brackish and freshwater tidal emergent wetlands to accommodate up to 3 feet of sea level rise where possible and allow for the future upslope establishment of tidal emergent wetland communities (Objective L1.7, associated with CM3, CM4, and CM8).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Allow lateral river channel migration (Objective L2.2, associated with CM3 and CM5).
- Within the 65,000 acres of tidal natural communities (L1.3), restore or create 24,000 acres of tidal freshwater emergent wetland in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1, associated with CM3 and CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle (Objective NFEW/NPANC1.1, associated with CM3 and CM10).
- Protect and enhance 8,100 acres of managed wetland, 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3 and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Protect stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Objective GNC1.3, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-23. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 9[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Aquatic (acres)	685	685	468	468	NA	NA
	Upland (acres)[e]	59	59	174	174	NA	NA
	Aquatic (miles)	1	1	8	8	**NA**	**NA**
Total Impacts CM1 (acres)		**744**	**744**	**642**	**642**	**NA**	**NA**
CM2–CM18	Aquatic (acres)	82	114	23	44	NA	NA
	Upland (acres)[e]	414	1,028	119	136	283–798	331
	Aquatic (miles)	25	109	3	4	NA	NA
Total Impacts CM2–CM18 (acres)		**496**	**1,142**	**142**	**180**	**283–798**	**331**
TOTAL IMPACTS CM1–CM18 (acres)		**1,240**	**1,886**	**784**	**822**	**283–798**	**331**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

[e] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 9 conservation measures would result in the permanent and temporary loss of up to 1,311 acres of aquatic habitat and 1,397 acres of upland nesting and overwintering habitat (Table 12-9-23). There are no western pond turtle occurrences that overlap with the CM1 footprint (Figure 12-16). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, and establishment and use of RTM, borrow, and spoils areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), seasonally inundated floodplain restoration (CM5), and riparian restoration (CM7). Habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western pond turtle habitat. The activity accounting for most (80%) of the habitat loss or conversion would be *CM4 Tidal Natural Communities Restoration*. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities would result in the permanent loss of approximately 685 acres of aquatic habitat and 59 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-9-23). Development of the water conveyance facilities would also result in the temporary removal of up to 468 acres of aquatic habitat and 174 acres of nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-9-23). Approximately 1 mile of channels providing western pond turtle movement habitat would be removed and 8 miles would be temporarily disturbed. There are no western pond turtle occurrences that overlap with the CM1 footprint but these are numerous occurrences scattered throughout the Delta. The majority of the permanent loss of aquatic habitat and nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high-value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering and dispersal habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. While there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the pipeline footprint.
- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the permanent and temporary removal of approximately 60 acres of aquatic habitat and 249 acres of upland nesting and overwintering habitat for the western pond turtle. Approximately 4 miles of channels providing western pond turtle movement habitat would be permanently or temporarily removed as a result of Yolo Bypass improvements. Although there are no CNDDB occurrences for western pond turtle in the Yolo Bypass, the species is known to be present in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2013).
- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of approximately 45 acres of aquatic habitat and 872 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Approximately 106 miles of channels providing western pond turtle movement habitat would be removed as a result of restoration. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration outside Suisun Marsh is likely to create suitable, slow-moving freshwater slough and marsh habitat.

  Although the aquatic habitat model includes all tidal perennial aquatic, tidal brackish emergent wetland, and managed wetland as habitat, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not hydrologically connected to Suisun Marsh. While the model does not include an aquatic class type called *drainage ditches* and therefore an effect on this habitat type cannot be calculated, it is likely that this general type of habitat accounts for a very small portion of the total modeled aquatic effects; almost certainly less than 5%, or less than 287 acres of the modeled aquatic habitat affected by tidal restoration. The suitable nesting and overwintering habitat that would be affected in the interior of Suisun Marsh is limited, because the levees likely function as the primary nesting and overwintering habitat. The nesting and overwintering habitat of highest value to be affected is on the fringe of the marsh where the aquatic habitat is adjacent to undeveloped grassland habitat.

The habitat affected in the interior Delta (West Delta and South Delta) is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle. Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent and temporary removal of approximately 53 acres of aquatic habitat and 33 acres of upland habitat for western pond turtle. Approximately 3 miles of channels providing western pond turtle movement habitat would be removed as a result of floodplain restoration. Although there are no CNDDB occurrences for pond turtles in the areas where floodplain restoration is likely to occur, the species is known to occur along the San Joaquin River to the south in the San Joaquin River National Wildlife Refuge. As with CM4, the estimates of the effect of seasonal floodplain levee construction and inundation are based on projections of where restoration may occur. Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration that is part of tidal natural communities restoration in CZ 1 and CZ 2, would result in the permanent removal of 10 acres of upland nesting and overwintering habitat for western pond turtle.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values over the term of the BDCP. In addition, effects would be avoided and minimized by the AMMs listed below.

  Management of the 6,600 acres of managed wetlands to be protected for waterfowl and shorebirds is not expected to result in overall adverse effects for the western pond turtle. Management actions that would improve wetland quality and diversity on managed wetlands include control and eradication of invasive plants; maintenance of a diversity of vegetation types and elevations, including upland areas to provide flood refugia; water management and leaching to reduce salinity; and enhancement of water management infrastructure (improvements to enhance drainage capacity, levee maintenance). These management actions could benefit the western pond turtle. The 6,600 acres of protected managed wetlands would be monitored and adaptively managed to ensure that management options are implemented to avoid adverse effects on the western pond turtle.
- Operations and maintenance: Ongoing maintenance of BDCP facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is

suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and conservation actions described below.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where conservation measures are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic or upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 9 would temporarily and permanently remove 1,258 acres of aquatic habitat and 766 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 1,153 acres of aquatic and 233 acres of upland habitats), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitats), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitats), and riparian restoration (CM7, 4 acres of upland habitat).

Typical project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 1,258 acres of aquatic habitat should be restored, 1,258 acres of aquatic habitat should be protected, and 1,532 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, and Objective MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation. Because the number of acres required to meet the typical ratios described above would be only 1,258 acres of aquatic communities protected, 1,258 acres restored, and 1,532 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 9 on western pond turtles would not be adverse.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM17 Western Pond Turtle*. These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 9 would remove 1,311 acres of aquatic habitat and 1,397 acres of upland habitat for western pond turtle in the late long-term timeframe.

Implementation of Alternative 9 as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 9%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 45,405 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

NEPA Effects: In the near-term, the loss of western pond turtle habitat under Alternative 9 would not be adverse because the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of western pond turtle habitat associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, and AMM17, the effects of Alternative 9 as a whole on western pond turtle would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because *CM1 Water Facilities and Operation* construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA.

Alternative 9 would temporarily and permanently remove 1,258 acres of aquatic habitat and 766 acres of upland nesting and overwintering habitat for western pond turtle in the near-term. These effects would result from water conveyance facilities construction (CM1, 1,153 acres of aquatic and 233 acres of upland habitats), Yolo Bypass improvements (CM2, 60 acres of aquatic and 249 acres of upland habitats), tidal habitat restoration (CM4, 45 acres of aquatic and 280 acres of upland habitats), and riparian restoration (CM7, 4 acres of upland habitat).

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for western pond turtle in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 1,258 acres of aquatic habitat should be restored, 1,258 acres of aquatic habitat should be protected, and 1,532 acres of upland habitat should be protected for western pond turtle to mitigate the near-term losses.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to near-term restoration and creation of up to 24,350 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, and Objective MWNC1.1) and up to 2,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the impacts of construction to constitute adequate mitigation for CEQA purposes. Because the number of acres required to meet the typical ratios described above would be only 1,258 acres of aquatic communities protected, 1,258 acres of aquatic communities restored and 1,532 acres of upland communities protected, the 24,350 acres of aquatic and 2,000 acres of upland habitats restored or created in the near-term Plan goals, and the additional detail in the biological goals for western pond turtle, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 9 on western pond turtles would be less than significant.

In addition, the plan also contains commitments to implement AMM1–6, AMM10, and AMM17, which include elements that would avoid or minimize the risk of directly and indirectly affecting habitats and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 9 would remove 1,311 acres of aquatic habitat and 1,397 acres of upland habitat for western pond turtle in the late long-term timeframe.

Implementation of Alternative 9 as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. While the extent of dispersal habitat is expected to be reduced by approximately 1%, this habitat is abundant in the study area (composed primarily of cultivated lands), is not believed to be a factor limiting the turtle, and would be replaced with higher-value habitats for western pond turtle.

The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The habitat protection and restoration needs for this species are addressed at the landscape and natural community levels. The BDCP has committed to late long-term restoration and creation of up to 74,300 acres of aquatic habitat (Objective L1.1, Objective L1.3, Objective NFEW/NPANC1.1, MWNC1.1) and up to 8,000 acres of upland habitat (Objective GNC1.1). In addition, the protection and management of existing managed wetland habitat in Suisun Marsh may increase the value of aquatic habitat. The most beneficial restoration would occur in freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 45,405 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian and floodplain restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where the floodplain is widened and restored, this would allow oxbows and slow-moving side channels to form, providing suitable aquatic habitat for this species (Bury and Germano 2008; Ernst and Lovich 2009). Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

The study area represents only a small portion of the range of the western pond turtle in California (which includes most all the Pacific drainages) and southern Oregon. Effects from permanent and temporary loss or conversion of habitat for the western pond turtle, and other effects described above, are not expected to result in an adverse effect on the long-term survival and recovery of western pond turtle because for the following reasons.

- The study area represents a small portion of the species' entire range.
- Only 1% of the habitat in the study area would be removed or converted.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of managed wetland, nontidal freshwater perennial emergent wetland, nontidal perennial aquatic, tidal brackish emergent wetland, tidal freshwater emergent wetland, grassland, valley foothill riparian, that could overlap with the species model, would result in the restoration of 29,738 acres of aquatic and 1,421 acres of upland modeled habitat for western pond turtle. In addition, protection of cultivated land, managed wetland, grassland, and valley/foothill riparian could overlap with the species model and would result in the protection of 1,281 acres of aquatic and 4,993 acres of upland western pond turtle modeled habitat.

The loss of western pond turtle habitat associated with Alternative 9 as a whole would represent an adverse effect as a result of habitat modification of a special-status species and the potential for direct mortality of turtles. However, considering the habitat restoration and protection associated with the conservation components, guided by landscape-scale goals and objectives and AMM1–AMM6, AMM10, and AMM17, which would be in place throughout the construction phase, the loss of habitat and potential mortality would not have an adverse effect on western pond turtle. Therefore, the loss of western pond turtle habitat and potential mortality of turtles from Alternative 9 would have a less-than-significant impact on western pond turtle.

Impact BIO-53: Indirect Effects of Plan Implementation on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting, overwintering, and dispersal habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances over the term of the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

Water operations would affect salinity gradients in Suisun Marsh. This effect mechanism cannot be disaggregated from tidal natural community restoration in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operation of salinity control gates to mimic a more natural water flow. Results of modeling for full implementation of the BDCP show salinity to double by the late long-term compared with current conditions during late fall and winter months. Changes in salinity would not be uniform across Suisun Marsh, as salinity would likely be more pronounced in some tidal channels and sloughs than others, and most of the salinity increase would occur during the fall and winter. Western pond turtles are primarily a freshwater species, although they can also be found in brackish marsh, and could respond negatively to increased salinity in Suisun Marsh. However, most of the Suisun Marsh pond turtle observations have been in the interior drainage ditches or near water control structures not connected to tidal channels and sloughs in Suisun Marsh which is where increases in salinity would occur. Therefore, the potential effects associated with changes in salinity are not expected to adversely affect western pond turtles.

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 9, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. Changes in water salinity would have a less-than-significant impact on western pond turtles because most of the salinity increases would occur in areas not used extensively by western pond turtles. With implementation of AMM1–AMM6, AMM10, AMM17, and AMM37 as part of Alternative 9 construction, operation, and maintenance, the BDCP would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 9 would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Conservation Components

CM2 Yolo Bypass Fisheries Enhancement would result in periodic inundation that could affect western pond turtle and its upland habitat. Appendix 5.J, *Effects on Natural Communities, Wildlife, and Plants* provides the method used to estimate periodic inundation effects in the Yolo Bypass. Based on this method, periodic inundation could affect from an estimated 283 acres of habitat during 1,000 cfs notch flow to an estimated 798 acres of habitat during 4,000 cfs notch flow (Table 12-4-23). This effect would occur during an estimated maximum of 30% of years, in areas that are already inundated in more than half of all years; therefore, these areas are expected to provide only marginal overwintering habitat for the western pond turtle under Existing Conditions. Furthermore, Yolo Bypass inundation is not expected to affect nesting western pond turtles because operations would not occur during the nesting season (approximately May through October). Therefore, Yolo Bypass operations are expect to have a minimal effect, if any, on western pond turtles in the Yolo Bypass.

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate 331 acres of upland habitat for the western pond turtle in the south Delta (CZ 7). Seasonal flooding in restored floodplains is not expected to adversely affect aquatic and dispersal habitat, because these habitat functions are expected to remain in the seasonally inundated floodplains. Floodplains are not expected to be inundated during the nesting season; however, turtle hatchlings may overwinter in the nest and could be affected by flooding. Restored floodplains would transition for areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more); adverse effects on turtle hatchlings are most likely at the lower elevations of the restored floodplain, where frequent flooding occurs.

NEPA Effects: Periodic effects on upland habitat for western pond turtle from CM2 and CM5 associated with implementing Alternative 9 are not expected to result in substantial adverse effects either directly or through habitat modifications because there would not be a substantial reduction in numbers or a restriction in the range of western pond turtles. Therefore, Alternative 9 would not adversely affect the species.

CEQA Conclusion: Flooding of the Yolo Bypass and creation of seasonally inundated floodplain in various parts of the study area would periodically affect a total of up to 283–798 acres from CM2 and approximately 331 acres from CM5 of upland habitat for western pond turtle. These acreages represent only 1% of the total upland western pond turtle habitat in the study area. Most of the increase in inundation would occur in the winter and early spring months, when western pond turtles may be in the water or overwintering and occupying upland habitats. Therefore, implementing Alternative 9, including AMM1–AMM6, AMM10, and AMM17, would not be expected to result in substantial adverse effects on western pond turtle, either directly or through habitat modifications, because it would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. Periodic effects of inundation under Alternative 9 would have a less-than-significant impact on the species.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 9 on the silvery legless lizard, San Joaquin coachwhip, and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10), which would not be affected by construction or restoration activities. This species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the coachwhip in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4) Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013). In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Alternative 9 is expected to result in the temporary and permanent removal of habitat that special-status reptiles uses for cover and dispersal (Table 12-9-24). BDCP actions that could affect this habitat are limited to construction and maintenance of the water conveyance facilities in the vicinity of Clifton Court Forebay, and grassland restoration, protection and management. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP that would also benefit special-status reptiles (BDCP Chapter 3, *Conservation Strategy*).

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Objective L2.6, associated with CM11).
- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3, CM8, and CM11).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-24. Changes in Special-Status Reptile Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Grassland[c]	20	20	10	10	NA	NA
Total Impacts CM1		**20**	**20**	**10**	**10**	**NA**	**NA**
CM2–CM18	Grassland[c]	0	0	O	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**20**	**20**	**10**	**10**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Grassland impacts include alkali seasonal wetland complex, grassland, and inland dune scrub habitats.

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 9 conservation measures would result in the permanent and temporary loss of 30 acres of potential habitat for special-status reptiles (Table 12-9-24). Water conveyance facilities and transmission line construction, including establishment and use of RTM, borrow, and spoils areas, (CM1) would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (CM11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to conservation components could have similar affects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 20 acres of habitat for special-status reptiles in the vicinity of Clifton Court Forebay. Construction-related effects would temporarily disturb 10 acres of suitable habitat for special-status reptiles in the study area.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55 *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicles may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. *P. blainvillii* may only be active during the early morning and evening hours in the summer (Morey 2000). Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 9 would remove 30 acres of grassland habitat for special-status reptiles. The typical NEPA mitigation ratio (2:1 for protection) for this natural community would indicate that 60 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55. to avoid and minimize injury or mortality of special-status reptiles during construction, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species from Alternative 9 would not be an adverse effect.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of 30 acres of habitat for special-status reptiles over the life of the plan.

Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan Area. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would replace unsuitable special-status reptile habitat, such as cultivated land, with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because the plan would result in a net increase in acreage of grassland habitat in the study area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

***NEPA Effects*:** In the near-term and late long-term, the loss of special-status reptile habitat under Alternative 9 would be not be adverse because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above and because of the implementation of Mitigation Measure BIO-55.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant under CEQA.

Alternative 9 would remove 30 acres of grassland habitat for special-status reptiles. The typical CEQA mitigation ratio (2:1 for protection) for this natural community would indicate that 60 acres should be protected in the near-term to offset CM1 losses.

The BDCP has committed to near-term restoration of 1,140 acres of grassland (CM8) and protection of up to 2,000 acres of grassland in the Plan Area (CM3). These conservation actions are all associated with CM3 and CM8 and would occur in the same timeframe as CM1 construction and early restoration losses, thereby avoiding adverse effects on special-status reptiles.

The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which would be close enough to the timing of construction impacts to constitute mitigation for CEQA purposes. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species would be a less-than-significant impact under CEQA.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of 30 acres of habitat for special-status reptiles over the life of the plan. Effects of water conveyance facilities construction would be offset through the plan's long-term commitment to protect up to 8,000 acres of grassland, and grassland associated with alkali seasonal wetlands and vernal pool complexes, and to restore 2,000 acres of grassland in the Plan Area (Objective GNC1.1 and Objective GNC1.2). Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (Objective GNC1.1). This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other effects would be reduced through implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs*. The plan as a whole is expected to benefit special-status reptiles that could be present by protecting potential habitat from loss or degradation that otherwise could occur with future changes in existing land use. To the extent that grassland habitat is restored in CZ 8, restoration would replace unsuitable special-status reptile habitat, such as cultivated land, with high-value cover, foraging, and dispersal habitat. The overall effect would be beneficial because the plan would result in a net increase in acreage of grassland habitat in the Plan Area.

BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction. Considering the BDCP conservation strategy and the implementation of Mitigation Measure BIO-55, the permanent and temporary loss of special-status reptile habitat and the potential mortality of either species under Alternative 9 would not result in a significant impact under CEQA.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support noncovered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ

4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work areas, the biologist will first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas of suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*, will be implemented for all noncovered special-status reptiles adversely affected by the BDCP to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Plan Implementation on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat over the term of the BDCP. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of *AMM10 Restoration of Temporarily Affected Natural Communities.* Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measures would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 9 on special-status reptiles would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

With implementation of Mitigation Measure BIO-55 as part of Alternative 9 construction, operation, and maintenance, the BDCP would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 9 would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on the California black rail. The habitat model used to assess effects for the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta includes all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat includes all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones, providing refugia during high tides, within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-9-25. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the California black rail (BDCP Chapter 3 Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Create 1,700 acres of black rail habitat between restored tidal freshwater emergent wetlands and transitional uplands to provide upland refugia (Objective CBR1.1, associated with CM4).

- Create topographic heterogeneity in restored tidal brackish and freshwater emergent wetlands (Objectives TBEWNC1.4 and TFEWNC2.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM38 California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-25. Changes in California Black Rail Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	15	15	296	296	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**15**	**15**	**296**	**296**	**NA**	**NA**
CM2–CM18	Primary	76	84	0	0	0	0
	Secondary	986	3,044	0	0	0	6
Total Impacts CM2–CM18		**1,062**	**3,128**	**0**	**0**	**09**	**6**
TOTAL IMPACTS		**1,077**	**3,143**	**296**	**296**		

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 9 conservation measures would result in the combined permanent loss or conversion and temporary loss of up to 395 acres of modeled primary habitat, and up to 3,044 acres of modeled secondary habitat for California black rail (Table 12-9-25). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1) and tidal habitat restoration (CM4). Habitat enhancement and management activities (CM11) activities, which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below. A summary statement of the combined NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 311 acres of modeled California black rail primary habitat, (15 acres of permanent loss, 296 acres of temporary loss)y habitat, Table 12-9-25). Activities that would permanently impact black rail habitat consist of instream island channel dredging. Permanent losses of habitat would occur from the dredging of Victoria Canal. Although the channel dredging in Middle River would avoid the majority of the instream islands, small portions of these islands would be permanently affected by this activity. Temporary disturbances of California black rail habitat would primarily occur from dredging activities in Middle River, which would cause temporary disturbances from dredging equipment use, turbidity, and other temporary effects. The CM1 permanent construction footprint overlaps with 16 California black rail occurrences in Middle River. Three of these occurrences overlap with the channel dredging footprint, and 13 occurrences are located in temporary dredging work areas. *AMM38 California Black Rail* would minimize potential effects of construction on nesting California black rail. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction or channel modification from fish passage improvements associated with the Yolo Bypass would result in the permanent removal of approximately 5 acres of primary California black rail habitat in CZ 2. There are no occurrences of California black rail that intersect with the CM1 footprint. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be affected by tidal marsh restoration. Some California black rail modeled habitat would be permanently lost such that it no longer serves as habitat, while other modeled habitat would change value through conversion from one habitat type to another. Tidal habitat restoration site preparation and inundation would result in the permanent loss of 79 acres of primary habitat and 3,044 acres of secondary habitat for California black rail. Of the 79 acres of primary habitat lost, an estimated 76 acres would be converted to low marsh, or secondary habitat, for the species due to increased water elevations.

  The majority of the effects of tidal natural communities restoration would occur in Suisun Marsh (CZ 11). Much of the natural wetland habitat that would be removed occurs in isolated patches and would be replaced by larger continuous areas of tidal wetlands that are expected to support higher habitat functions for the rail than the impacted wetlands. As described in the BDCP, restoration of up to 24,000 acres of tidal freshwater emergent wetland in the Delta and at least 6,000 acres of tidal brackish emergent wetland natural communities in CZ 11 by the late long-term would benefit California black rail. The primary habitat for the species in the Delta consists of inchannel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under CM4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration projects would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

  The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before the initiation of restoration actions in other areas. However, California black rails have a greater use of mature tidal marshes and, therefore, it would be years before the newly restored marshes provided suitable habitat for the species. In the long-term, tidal natural communities restoration is expected to have little to no adverse effects on California black rail habitat because the habitat removed would be replaced by a greater acreage of high-value tidal wetland and, thus, is expected to provide a benefit for California black rail.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions contained in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values over the term of the BDCP. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below. Additional actions under CM11 include the control of nonnative predators to reduce nest predation as needed.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the surrounding habitat in Suisun and the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California black rail. Increased vehicular traffic associated with BDCP actions could contribute to a higher incidence of road kill. However, conducting construction outside of the breeding season where feasible (reducing the risk of impacting active nests), construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of the species during construction, as required by AMM1–AMM7 and *AMM38 California Black Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 9 implementation, there would be a loss of 1,373 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 311 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass*

Fisheries Enhancement and *CM4 Tidal Natural Communities Restoration*—76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 311 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives for California black rail satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 395 acres of primary habitat and 3,044 acres of secondary habitat for

California black rail during the term of the Plan (2% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

NEPA Effects: The loss of California black rail habitat and potential direct mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, guided by the biological objectives for the species and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*, which would be in place throughout the construction period, the effects of Alternative 9 as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 9 implementation, there would be a loss of 1,373 acres of modeled habitat for California black rail in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 311 acres of primary habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration*—76 acres of primary habitat, 986 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for California black rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of wetland natural communities such as tidal freshwater emergent wetland, tidal brackish emergent wetland, and managed wetland. Using this ratio would indicate that 311 acres of tidal natural communities should be restored/created to compensate for the CM1 losses of California black rail habitat. The near-term effects of other conservation actions would remove 1,062 acres of tidal natural communities, therefore requiring 1,062 acres of tidal natural communities restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, 8,850 acres of tidal freshwater emergent wetland, and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are all associated with CM4 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on California black rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and the tidal freshwater emergent wetland would be restored in CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, and/or CZ 7 (Objective TFEWNC1.1). In addition, tidal brackish and tidal freshwater emergent wetlands would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4 and TFEWNC2.2). Portions of the 4,800 acres of managed wetland protected and enhanced in CZ 11 would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Alternative 9 implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM38 California Black Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 3,608 acres of restored/created tidal natural communities, the 10,850 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for California black rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 395 acres of primary habitat and 3,044 acres of secondary habitat for California black rail during the term of the Plan (2% of the total primary habitat in the study area and 17% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) and at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (TFEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for California black rail in Suisun Marsh (Objective TBEWNC1.1). In the Delta, at least 1,700 acres of upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Objectives TBEWNC1.4, TFEWNC2.2, and CBR1.1). Portions of the 8,100 acres of managed wetland protected and enhanced in CZ 11 as part of *CM3 Natural Communities Protection and Restoration* would benefit the California black rail through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable nesting habitat for California black rail (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above would result in the restoration of 3,579 acres of primary habitat and 12,115 acres of secondary habitat for California black rail and the protection of 275 acres of secondary habitat for the species.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on California black rail.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of California black rail. A variety of rail species are known to suffer mortality from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al 1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires. California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al 1994). However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would eliminate any potential for mortality of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for transmission lines constructed in the Delta to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase risk of predation on California black rail from an increase in raptor perching opportunities would be negligible.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines and select existing powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increased risk of predation on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California black rail because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would minimize the risk of bird strike for California black rails in the Delta. The increased risk of predation on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Plan Implementation on California Black Rail

Indirect Construction-Related Effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in AMM38 that preconstruction surveys of potential breeding habitat would be conducted within 700 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008); however, the majority of the overlap between restoration areas and black rail habitat is within Suisun Marsh, where conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM 12 would be implemented to address this risk of low level increases in methylmercury that could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4, CM5) would lead to adverse effects on California black rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California black rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects**:** Noise and visual disturbances related to construction-related activities from conservation measures could disturb California black rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California black rail would be minimized with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration actions that would create high and low tidal marsh, which is black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities and other conservation measures could disturb primary and secondary California black rail habitat adjacent to work sites. *AMM38 California Black Rail* would avoid and minimize impacts on California black rail from noise and visual disturbance. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species. These impacts on California black rail would be less than significant with the incorporation of AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, into the BDCP. Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail through the establishment of tidal marsh similar to historic conditions.

Tidal habitat restoration is unlikely to have a significant impact on California black rail through increased exposure to methylmercury, as rails currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on California black rail.

Tidal habitat restoration could result in increased exposure of California black rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Restoration Actions that would create high and low tidal marsh, which is Black Rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the planned ROA's do not overlap with the areas of highest mercury concentrations, which are in the in Yolo Bypass. Also, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on California black rail. No mitigation would be required.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and potentially temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *CM4 Tidal Natural Community Restoration* activities. The tidal natural communities restoration would be phased through the course of the BDCP restoration program to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

***NEPA Effects*:** The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would not result in the periodic inundation of modeled habitat for California black rail. There are no records for California black rails in the Yolo Bypass, although the species is highly secretive and the extent to which the area has been surveyed for California black rails is unknown. Therefore, there is potential for the species to occur in the Yolo Bypass. In addition, rails may occur in the bypass after restoration activities are completed. However, periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in increased magnitude, frequency and duration of periodic inundation by up to 6 acres of modeled California black rail habitat in CZ 7. The risk of changes in inundation frequency, magnitude, and duration through CM2 and CM5 affecting California black rail are considered to be low, and would not be expected to result in adverse effects on the species.

NEPA Effects: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration through CM2 and CM5 affecting California black rail is considered to be low.

CEQA Conclusion: Periodic inundation under *CM2 Yolo Bypass Fisheries Enhancement* and *CM5 Seasonally Inundated Floodplain Restoration* would represent a less-than-significant impact on California black rail because periodic inundation would not result in permanent habitat loss and would not prevent use of the bypass by current or future rail populations. The risk of changes in inundation frequency and duration as a result of CM2 and CM5 affecting California black rail is considered to be low.

California Clapper Rail

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on California clapper rail. California clapper rail habitat includes mostly middle marsh habitat with select emergent wetland plant alliances. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and forage. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Covered Species Accounts*.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of California clapper rail modeled habitat as indicated in Table 12-9-26. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the California clapper rail (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM19 California Clapper Rail*, and *AMM27 Selenium Management*, impacts on the California clapper rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-26. Changes to California Clapper Rail Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	26	27	0	0	0	0
	Secondary	50	50	0	0	0	0
Total Impacts CM2–CM18		**76**	**77**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**76**	**77**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

Alternative 9 conservation measures would result in the total loss or conversion of up to 77 acres of modeled clapper rail habitat consisting of 27 acres of primary habitat and 50 acres of secondary habitat (Table 12-9-26). The conservation measure that would result in these losses is tidal natural communities restoration (CM4). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would convert approximately 77 acres of modeled California clapper rail habitat (27 acres of primary habitat, 50 acres of secondary habitat), the majority of which would occur in CZ 11. The tidal marsh restoration action would not result in the permanent loss of any California clapper rail habitat in the study area. However, approximately 27 acres of primary habitat would be converted to secondary low marsh habitat and 50 acres of secondary habitat would be converted to middle or high marsh. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11. Tidal wetlands would be restored as a mosaic of large, interconnected, and biologically diverse patches that supported a natural gradient extending from subtidal to the upland fringe. Much of the restored tidal brackish emergent wetland would meet the primary habitat requirements of the California clapper rail, including development of mid- and high-marsh vegetation with dense, tall stands of pickleweed cover. Restoration would be sequenced and spaced in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.

- *CM11 Natural Communities Enhancement and Management*: Because the entire California clapper rail population is restricted to the San Francisco Bay Area estuary, BDCP enhancement and restoration actions would be expected to benefit the species by creating the potential for extending its abundance and distribution in Suisun Marsh. Occupied California clapper rail habitat would be monitored to determine if there is a need for predator control actions. If implemented, nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored and protected tidal wetland habitats could result in localized ground disturbances that could temporarily remove small amounts of California clapper rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available California clapper rail habitat. These potential effects are currently not quantifiable, but would be minimized with implementation *AMM19 California Clapper Rail* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect California clapper rail use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction vehicle activity may cause injury or mortality to California black rail. If rails are present adjacent to covered activities, the operation of equipment for land clearing, and habitat restoration, enhancement, and management could result in injury or mortality of California clapper rail. Operation of construction equipment could result in injury or mortality of California clapper rails. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is less likely as these individuals are expected to avoid contact with construction equipment. However, nest sites would be avoided during the nesting season as required by AMM1–AMM7 and *AMM19 California Clapper Rail*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to compensate for the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4). These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions. The acres of restoration contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 50 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun

Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and at least 1,500 acres of the restored marsh would consist of middle-and high-marsh vegetation, serving as primary habitat for California clapper rail in Suisun Marsh (Objectives TBEWNC1.1 and TBEWNC1.2). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, *Effects Analysis*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: In the absence of other conservation actions, the loss of California clapper rail habitat associated with Alternative 9 would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with CM4, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*, which would be in place throughout the construction period, the effects of Alternative 9 as a whole on California clapper rail would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 76 acres of modeled habitat for California clapper rail in the study area in the near-term from the implementation of *CM4 Tidal Natural Communities Restoration* (26 acres of primary and 50 acres of secondary habitat).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM4 and that are identified in the biological goals and objectives for California clapper rail in

Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 76 acres of tidal brackish emergent wetland should be restored/created to mitigate the CM4 losses of California clapper rail habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland in the study area. These conservation actions are associated with CM4 and would occur in the same timeframe as the early restoration losses, thereby avoiding adverse effects on California clapper rail. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objectives TBEWNC1.4).

These biological goals and objectives would inform the near-term restoration efforts and represent performance standards for considering the effectiveness of restoration actions. These Plan objectives represent performance standards for considering the effectiveness of CM4 restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of restoration impacts to constitute adequate mitigation for CEQA purposes. In addition, *AMM19 California Clapper Rail* and AMM1–AMM7 would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 76 acres of restored tidal natural communities, the 2,000 acres of tidal brackish emergent wetland restoration contained in the near-term Plan goals, and the additional detail in the biological objectives for California clapper rail, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 296 acres of primary and 6,420 acres of secondary habitat for California clapper rail. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 27 acres of primary habitat and 8 acres of secondary habitat for California clapper rail during the term of the Plan (9% of the total primary habitat in the study area and less than 1% of the total secondary habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create at least 6,000 acres of tidal brackish emergent wetlands for California clapper rail in Suisun Marsh in CZ 11 (Objective TBEWNC1.1). These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches and much of the restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed, serving as primary habitat for clapper rail in Suisun Marsh (Objective TBEWNC1.1). Additional pressures on the species such as loss of habitat from invasive species and mortality from nest predators would also be addressed through the BDCP. Perennial pepperweed, which outcompetes suitable clapper rail habitat (such as pickleweed) would be reduced to no more than 10% cover in the tidal brackish emergent wetland natural community within CZ 11 (Objective TBEWNC2.1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *CM11 Natural Communities Enhancement and Management*.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, would result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat for California clapper rail.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM19 California Clapper Rail*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of California clapper rail. Therefore, the alternative would have a less-than-significant impact on California clapper rail.

Impact BIO-63: Indirect Effects of Plan Implementation on California Clapper Rail

Indirect Construction-Related Effects: California clapper rail habitat within the vicinity of proposed restoration areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California clapper rail. The use of mechanical equipment during construction-related restoration activities could cause the accidental release of petroleum or other contaminants that could affect California clapper rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California clapper habitat could also affect the species. If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and mortality of any eggs and/or nestlings. However, there is a commitment in *AMM19 California Clapper Rail* that preconstruction surveys of potential breeding habitat would be conducted within 500 feet of project activities, and a 500-foot no-disturbance buffer would be established around any territorial call-centers during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Preconstruction surveys conducted under *AMM19 California Clapper Rail* would ensure construction-related noise and visual disturbances would not have an adverse effect on California clapper rail. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and ensure measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Therefore, with the implementation of AMM1–AMM7 and *AMM19 California Clapper Rail*, there would be no adverse effect on California clapper rail.

Salinity: Water operations under Operational Scenario A would have an effect on salinity gradients in Suisun Marsh. These effects cannot be disaggregated from tidal habitat restoration, which would also cause changes in salinity gradients. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which would be beneficial to California clapper rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rails are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on California clapper rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the California clapper rail. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California clapper rail. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California clapper rail.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California clapper rail from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances related to construction-related activities from conservation measures could disturb California clapper rail habitat adjacent to work sites. Potential effects of noise and visual disturbances on California clapper rail would be minimized with *AMM19 California Clapper Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions. Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, changes in salinity, and increased exposure to selenium from Alternative 9 implementation would not have an adverse effect on California clapper rail.

CEQA Conclusion: Noise and visual disturbances related to construction-related activities from the conservation measures could disturb approximately 542 acres of California clapper rail habitat adjacent to work sites. *AMM19 California Clapper Rail* would avoid and minimize impacts on California clapper rail from noise and visual disturbance. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants or the inadvertent discharge of sediment or excessive dust adjacent to California clapper rail habitat could also affect the species. These impacts on California clapper rail would be less than significant with the incorporation of AMM1–AMM7 into the BDCP. Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on

California clapper rail through the establishment of tidal marsh similar to historic conditions. Tidal habitat restoration could result in increased exposure of California clapper rail to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the California clapper rail foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With these measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the Plan Area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to 3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Conservation Component Implementation

Restoration activities may temporarily fragment existing wetlands in Suisun Marsh and could create temporary barriers to movements of California clapper rail. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and, thus, temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal brackish emergent wetland habitat for California clapper rail or restoration activities resulting in barriers to movement would be minimized through sequencing of restoration activities to minimize effects of temporary habitat loss. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California clapper rail as a result of special-status species habitat modification because *CM4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

***CEQA Conclusion*:** The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California clapper rail as a result of habitat modification of a special status species because Tidal Natural Communities Restoration (CM4) would be phased to allow for the recovery of some areas before initiating restoration actions in other areas. In addition, In addition, *AMM19 California Clapper Rail* would avoid and minimize effects on California clapper rail.

California Least Tern

This section describe the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of California least tern modeled habitat as indicated in Table 12-9-27. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit California least tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore and protect at least 65,000 acres of tidal natural communities and transitional uplands to accommodate sea level rise (Objective L1.3, associated with CM4).
- Within the 65,000 acres of tidal natural communities and transitional uplands, restore or create tidal perennial aquatic natural community as necessary when creating tidal emergent wetland (Objective TPANC1.1, associated with CM4).
- Control invasive aquatic vegetation that adversely affects native fish habitat (Objective TPANC2.1, associated with CM13).

Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and the west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation).

As explained below, with the restoration and protection of tidal perennial aquatic foraging habitat, in addition to natural community enhancement and management commitments (including CM12 *Methylmercury Management*) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and mitigation to avoid impacts on terns should they nest in the study area, impacts on the

California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-27. Changes in California Least Tern Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Foraging	675	675	345	345	NA	NA
Total Impacts CM1		**675**	**675**	**345**	**345**	**NA**	**NA**
CM2–CM18	Foraging	38	46	11	16	NA	NA
Total Impacts CM2–CM18		**38**	**46**	**11**	**16**	**NA**	**NA**
TOTAL IMPACTS		**713**	**721**	**356**	**361**	**NA**	**NA**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 1,082 acres of modeled foraging habitat for California least tern, consisting of 721 acres of permanent loss and 361 acres of temporary loss (Table 12-9-27). The conservation measures that would result in these losses are construction of water conveyance facilities and operation (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). The majority of the permanent and temporary losses would occur during the first 10 years of BDCP implementation, as water conveyance facilities are constructed and habitat restoration is initiated. The majority of the permanent and temporary losses would occur during the first 10 years of BDCP implementation, as water conveyance facilities are constructed and habitat restoration is initiated. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 1,020 acres of modeled California least tern aquatic foraging habitat (Table 12-9-27). Of the 1,020 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 345 acres would be a temporary loss. Permanent impacts on California least tern foraging habitat would include canal Construction, dredging for channel enlargement, and operable barrier construction. However, impacts would not permanently remove the waterways, but would permanently modify the channel bottoms and eliminate any associated aquatic vegetation. The temporary effects on California least tern foraging habitat would occur primarily along the channels of the Middle River and Victoria Canal, where temporary work areas would be needed to support channel dredging operations. Several smaller temporary impact areas would occur where barge operations areas would be developed. The CM1 footprint does not overlap with any California least tern occurrences. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized,* (described below) would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on terns were they to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancement would result in the permanent loss of 8 acres and the temporary loss of 11 acres of modeled aquatic foraging habitat for California least tern in CZ 2. Activities from Fremont and Sacramento Weir improvements, Putah Creek realignment, and Lisbon Weir modification could involve excavation and grading in tidal perennial aquatic areas to improve passage of fish through the bypasses. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration actions would result in the permanent loss of 36 acres of modeled aquatic foraging habitat for California least tern. An estimated 65,000 acres of tidal wetlands would be restored during tidal habitat restoration, consistent with BDCP Objective L1.3. Of these acres, an estimated 27,000 acres of tidal perennial aquatic would be restored, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). This restoration is consistent with BDCP Objective TPANC1.1. Tidal perennial aquatic restoration would be expected to substantially increase the primary productivity of fish, increasing the prey base for California least tern. Approximately 3,400 acres of the restoration would happen during the first 10 years of BDCP implementation, which would coincide with the timeframe of water conveyance facilities construction. The remaining restoration would be phased over the following 30 years. Some of the restoration would occur in the lower Yolo Bypass, but restoration would also be spread among the Suisun Marsh, South Delta, Cosumnes/Mokelumne and West Delta ROAs.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would result in the permanent loss of 2 acres and the temporary loss of 5 acres of modeled aquatic foraging habitat for California least tern. This activity is scheduled to start following construction of water conveyance facilities, which is expected to take 10 years. Specific locations for the floodplain restoration have not been identified, but it is expected that much of the activity would occur in the south Delta along the major rivers.
- *CM11 Natural Communities Enhancement and Management*: Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands.

Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and injury mortality and noise and visual disturbance of nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic postconstruction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the BDCP. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs listed below.
- Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in Suisun Marsh and west Delta area (CZ 10 and CZ 11). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or mortality would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraph summarizes the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. With Alternative 9 implementation, there would be a loss of 1,069 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,020 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 1,069 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3, *Description of Alternatives*).This conservation action would result in the creation of approximately 3,400 acres of high quality tidal perennial aquatic natural community, based on modeling conducted by ESAPWA (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*) (Tidal perennial aquatic) restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3, Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The California least tern is not a species that is covered under the BDCP. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would be available to address this adverse effect on nesting California least terns.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,082 acres of foraging habitat during the term of the Plan (1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* would restore an estimated 27,000 acres of high quality tidal perennial aquatic natural community would be restored (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

NEPA Effects: The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 9 would represent an adverse effect in the absence of other conservation actions. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this adverse effect on nesting California least terns. With habitat restoration associated with CM4 and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*, which would be in place throughout the construction period, the effects of Alternative 9 as a whole on California least tern would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. With Alternative 9 implementation, there would be a loss of 1,069 acres of modeled foraging habitat for California least tern in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,020 acres), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2], and tidal habitat restoration [CM4] - 49 acres). All modeled foraging habitat impacts would occur in tidal perennial aquatic natural communities.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by CM1 would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 1,069 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the CM1 losses of California least tern foraging habitat. The near-term effects of other conservation actions would remove 49 acres of tidal perennial aquatic habitat, and therefore require 49 acres of tidal perennial aquatic natural community restoration using the same typical NEPA and CEQA ratio (1:1 for restoration).

The BDCP has committed to near-term goals of restoring 19,150 acres of tidal natural communities in the Plan Area through *CM4 Tidal Natural Communities Restoration* (Table 3-4 in Chapter 3). Modeling conducted by ESA PWA indicates that this conservation action would result in the creation of approximately 3,400 acres of high-value tidal perennial aquatic natural community (refer to Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). Tidal perennial aquatic restoration would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects on California least tern.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3, Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would reduce the impact on nesting California least terns to a less-than-significant level.

The natural community restoration and protection activities would be concluded in the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. In addition, AMM1–AMM7 and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would avoid and minimize potential impacts on the species from construction-related habitat loss and noise and disturbance. Because the number of acres required to meet the typical mitigation ratio described above would be only 2,309 acres of restored tidal perennial aquatic habitat, the 3,400 acres of tidal perennial aquatic restoration estimated in the near-term, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality under Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 86,263 acres of foraging habitat for California least tern. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,082 acres of foraging habitat during the term of the Plan (1% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore an estimated 27,000 acres of high-value tidal perennial aquatic natural community (estimated from Table 5 in BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*). The restoration would occur over a wide region of the study area, including within the Suisun Marsh, Cosumnes/Mokelumne, Cache Creek, and South Delta ROAs (see Figure 12-1).

In the absence of other conservation actions, the loss of California least tern foraging habitat and potential direct mortality associated with Alternative 9 would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality. Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have a significant impact on California least tern. The loss of California least tern foraging habitat and potential direct mortality associated with Alternative 9 would represent a significant impact in the absence of other conservation actions. However, with habitat restoration associated with CM4, and guided by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and with implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, the loss of habitat or mortality under this alternative would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet of California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of Plan Implementation on California Least Tern

Indirect Construction- and Operation-Related Effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills from occurring or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and large mouth bass tissues were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in BDCP Appendix 5.D, *Contaminants*).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. CM12, described below, will be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would be available to address this potential adverse effect. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species. Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Noise and visual disturbances within 500 feet of construction-related activities from the CMs could disturb California least tern foraging habitat adjacent to work sites. Implementation of Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under CM1 would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-7, AMM12, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of plan implementation would not result in a substantial adverse effect on the species through habitat modification or potential mortality of a special-status species. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of mortality of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would substantially reduce the potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of direct mortality of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on greater sandhill crane. Greater sandhill cranes in the Plan Area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes “roosting and foraging” and “foraging” habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (BDCP Appendix 2.A, *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the value of affected habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (BDCP Appendix 2A).

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-9-28. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the greater sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat would be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. Selection of protected habitat locations would consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Objective GSHC1.1, associated with CM3).

- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 would involve acquiring low-value habitat or nonhabitat areas and converting them to high- or very high-value habitat. Habitat would be created within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. Selection of protected habitat locations would consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).
- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands would be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).
- Create at least two 90-acre wetland complexes within the Stone Lakes NWR project boundary. The complexes would be no more than 2 miles apart and would help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex would consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and would be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that would be flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes NWR for greater sandhill crane (Objective GSHC1.4, associated with CM10).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat would consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields would be at least 40 acres and locations may be shifted throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27*

*Selenium Managemen*t, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would be less than significant for CEQA purposes.

Table 12-9-28. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Roosting and Foraging - Permanent	0	0	0	0	NA	NA
	Roosting and Foraging - Temporary	0	0	25	25	NA	NA
	Foraging	37	37	552	552	0	0
Total Impacts CM1		**37**	**37**	**577**	**577**	**0**	**0**
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	2,776	4,367	0	0	0	0
Total Impacts CM2–CM18		**2,776**	**4,408**	**0**	**0**	**0**	**0**
Total Roosting/Foraging – Permanent		**0**	**0**	**0**	**0**	**0**	**0**
Total Roosting/Foraging – Temporary		**0**	**41**	**25**	**25**	**0**	**0**
Total Foraging		**2,813**	**4,404**	**552**	**552**	**0**	**0**
TOTAL IMPACTS		**2,813**	**4,445**	**577**	**577**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 66 acres of modeled roosting and foraging habitat for greater sandhill crane (41 acres of permanent loss and 25 acres of temporary loss) and 4,956 acres of foraging habitat for greater sandhill crane (4,404 of permanent loss, 552 acres of temporary loss, Table 12-9-28). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management

(CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities as they are currently designed would result in the permanent loss of up to 37 acres of modeled greater sandhill crane foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 1 acre of very high-value, 0 acres of high-value, and 9 acres of medium-value foraging habitat (Table 12-9-29). Permanent loss of foraging habitat would result from intake and fish screen construction, channel enlargement, and transmission line construction in CZ 4, 5, and 6. Fish barrier construction would permanently impact foraging habitat in CZ 6 on Bradford Island, Bacon Island, north of Woodward Island, and between Mandeville and Bradford Island. In addition, 25 acres of temporary roosting and foraging habitat, and 552 acres of foraging habitat would be temporarily removed (Table 12-9-28). Temporary habitat loss would primarily result from potential borrow and spoil areas (367 acres) and work areas for the above construction activities. The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands.

  The temporary roosting and foraging habitat that would be temporarily impacted is located on the east side of Bradford Island. The temporary roost site would be impacted by a concrete batch plant, an operable barrier work area, and a borrow and spoil area. The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described for *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

Table 12-9-29. Total Amount of Greater Sandhill Crane Foraging Habitat Affected under Alternative 9

Foraging Habitat Value Class	Land Cover Type	Acres Affected by CM1 permanent (temporary)	Acres Affected by CM2–CM18 permanent (temporary)
Very high	Corn, rice	1 (51)	1,155 (0)
High	Wheat, managed wetlands,	0 (8)	489 (0)
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	9 (348)	1,403 (0)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	27 (145)	1,320 (0)
Total		**37 (552)**	**4,367**

- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 2,754 acres of greater sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 2,713 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 716 acres of very high-value, 304 acres of high value, 873acres of medium-value, and 821 acres of low-value foraging habitat This loss would occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. In CZ 5, loss of modeled habitat would occur along the western edge of the greater sandhill crane winter use area and therefore would not result in fragmentation of traditional crane habitats. Therefore fragmentation of habitat from tidal restoration activities would be expected to be minimal. Approximately 1,951 acres of foraging habitat would be impacted within the first 10 years of Alternative 9 implementation.
- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands that provide foraging habitat for greater sandhill crane would be converted to grassland by the late long-term timeframe. No roosting/foraging habitat would be impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the greater sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Plan implementation.

- *CM10 Nontidal Marsh Restoration:* Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the greater sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 9 implementation.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, greater sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of Alternative 9 implementation).
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, impacts would be reduced by AMMs, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of greater sandhill crane if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. The potential for injury and direct mortality from electrical transmission facilities is discussed below under Impact BIO-70.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, Alternative 9 would remove 25 acres roosting and foraging habitat (temporary loss from CM1) in the study area in the near-term. In addition, 3,364 acres of foraging habitat would be removed or converted in the near-term (CM1, 589 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 2,352 acres would be moderate- to very high-value habitat (CM1, 417 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 25 acres of greater roosting habitat should be restored/created and 25 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 417 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 25 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses. Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a, *Compensate for the Loss of Medium- to Very High-Value Greater Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 66 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 4,956 acres of foraging habitat (3% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 3,464 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWRproject boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

To compensate for near-term impacts on crane roosting and foraging habitat, 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). To create additional high-value foraging habitat in the study area, 10% of these acres of protected foraging habitat would result from the conversion of low-value or nonhabitat areas to high- or very high-value habitat (Objective GSHC1.2). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Based on current design footprints, Alternative 9 would remove 25 acres roosting and foraging habitat (temporary loss from CM1) in the study area in the near-term. In addition, 3,364 acres of foraging habitat would be removed or converted in the near-term (CM1, 589 acres; *CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—2,776 acres). Of these near-term acres of foraging habitat impact, 2,352 acres would be moderate- to very high-value habitat (CM1, 417 acres, CM4-11, 1,935 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for greater sandhill crane in Chapter 3 of the BDCP would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of moderate- to very high-value foraging habitat. Using these ratios would indicate that 25 acres of greater roosting habitat should be restored/created and 25 acres should be protected to compensate for the CM1 losses of greater sandhill crane roosting and foraging habitat. In addition, 417 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of greater sandhill crane moderate- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 1,935 acres of moderate- to very high-value foraging habitat, and therefore require 1,935 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no greater sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 25 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses. Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes National Wildlife Refuge project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-69a would be available to guide the near-term protection of cultivated lands to ensure that the near-term impacts of moderate- to very high-value habitat for greater sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 164,676 acres of foraging habitat for greater sandhill crane. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 66 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 4,956 acres of foraging habitat (3% of the total habitat in the study area) for the greater sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 3,464 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1).

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWRproject boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. One of the 90-acre wetland complexes created under this objective could be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

To compensate for near-term impacts on crane roosting and foraging habitat, 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). To create additional high-value foraging habitat in the study area, 10% of these acres of protected foraging habitat would result from the conversion of low-value or nonhabitat areas to high- or very high-value habitat (Objective GSHC1.2). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, in addition to Mitigation Measure BIO-69a, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1 prior to or concurrent with impacts, loss of habitat and direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on greater sandhill crane.

Mitigation Measure BIO-69a: Compensate for the loss of Medium to Very High-Value Greater Sandhill Crane Foraging Habitat

DWR will compensate for the loss of greater sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent within the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging habitat value categories are listed in Table 12-9-29. Foraging habitat conservation must occur within the greater sandhill crane winter use area and the location of protected habitat or conservation easements must be preapproved by the USFWS and CDFW.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 9 facilities. The potential for birdstrikes could also be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 9 was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Typically, higher-voltage (230-kV) lines vary in height from 90 to 110 feet, while subtransmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 9 alignment would primarily use existing transmission and distribution lines and would require the installation of approximately 42 miles of transmission line (3 miles of 60-kV line, 38 miles of 12-kV line, and 0.5 miles of 480-V line). These lines would occur in the vicinity of Walnut Grove and adjacent to fish screen and operable barrier structures throughout the CM1 footprint. Temporary lines would be removed after construction of the water conveyance facilities, within 10 years.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the

Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 9 meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures (described above) under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters will be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing mortality in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 9 is not fully designed, and line locations are not final. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 9 would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 9 is not fully designed, and line locations are not final. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 9 would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of Plan Implementation on Greater Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 9 and to determine that as much as 1,217–5,108 acres of crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). This would include 44 – 157 acres of temporary crane roosting habitat and 1,173 – 4,951 acres of crane foraging habitat. In addition, 0-40 acres of permanent crane roosting habitat, 38 – 688 acres of temporary crane roosting habitat, and 1,392 – 7,699 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-9-30). The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-9-30. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 9 (acres)

	General Construction		Pile Driving	
Habitat Type	Above 60 dBA	Above 50 dBA	Above 60 dBA	Above 50 dBA
Permanent Roosting	0	0	0	40
Temporary Roosting	44	157	38	688
Foraging	1,173	4,951	1,392	7,699
Total Habitat	**1,217**	**5,108**	**1,430**	**8,426**

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on greater sandhill crane. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Therefore, potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect greater sandhill crane via uptake in lower trophic levels (see Appendix 5.D, *Contaminants*, of the BDCP). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Crane habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of greater sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in greater sandhill cranes would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of greater sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 9 would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on greater sandhill crane.

Lesser Sandhill Crane

Lesser sandhill cranes in the Plan Area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane identifies “roosting and foraging” and “foraging” habitat. These habitat types include suitable foraging and roosting habitat in the study area as certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat consists of traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and that provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in BDCP Appendix 2.A *Covered Species Accounts.* Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. The assessment of the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-9-31. Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP that would benefit the lesser sandhill crane (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 7,300 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. Habitat would be protected within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. The selection of protected habitat locations would consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands would be at least 160 acres (Objective GSHC1.1, associated with CM3).

- To create additional high-value greater sandhill crane winter foraging habitat, 10% of the habitat protected under Objective GSHC1.1 would involve acquiring low-value habitat or nonhabitat areas and converting it to high- or very high-value habitat. Habitat would be created within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6. The selection of areas in which habitat would be created would consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss (Objective GSHC1.2, associated with CM3).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands would be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Objective GSHC1.3, associated with CM3).

- Create at least two 90-acre wetland complexes within the Stone Lakes NWR project boundary. The complexes would be no more than 2 miles apart and would help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex would consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and would be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes NWR for greater sandhill crane. (Objective GSHC1.4, associated with CM10).

- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat would consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields would be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss (Objective GSCH1.5, associated with CM3).
- Target cultivated land conservation to provide connectivity between other conservation lands (Objective CLNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-31. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Roosting and Foraging - Permanent	0	0	0	0	NA	NA
	Roosting and Foraging - Temporary	0	0	25	25	NA	NA
	Foraging	44	44	1,600	1,600	NA	NA
Total Impacts CM1		**44**	**44**	**1,625**	**1,625**	**NA**	**NA**
CM2–CM18	Roosting and Foraging - Permanent	0	0	0	0	0	0
	Roosting and Foraging - Temporary	0	41	0	0	0	0
	Foraging	3,610	12,131	2	4	0	0
Total Impacts CM2–CM18		**3,610**	**12,172**	**2**	**4**	**0**	**0**
Total Roosting and Foraging - Permanent		**0**	**0**	**0**	**0**	**0**	**0**
Total Roosting and Foraging - Temporary		**0**	**41**	**25**	**25**	**0**	**0**
Total Foraging		**3,654**	**12,175**	**1,602**	**1,604**	**0**	**0**
TOTAL IMPACTS		**3,654**	**12,216**	**1,627**	**1,629**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 66 acres of modeled roosting and foraging habitat (41 acres of permanent loss and 25 acres of temporary loss) and 13,779 acres of foraging habitat (12,175 acres of permanent loss and 1,604 acres of temporary loss) for lesser sandhill crane Table 12-9-31). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass Fisheries Improvements (CM2), Tidal Natural Communities Restoration (CM4), Grassland Natural Community Restoration (CM8), Nontidal Marsh Natural Community Restoration (CM10), and Natural Communities Enhancement and Management (CM11). The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to tidal natural communities through CM4. Habitat enhancement and management activities through CM11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities as they are currently designed would result in the permanent loss of up to 44 acres of lesser sandhill crane foraging habitat. Foraging habitat that would be permanently impacted by CM1 would consist of 9 acre of very high-value, 2 acres of high-value, and 29 acres of medium-value foraging habitat (Table 12-9-32). Permanent loss of foraging habitat would result from intake and fish screen construction, channel enlargement, and transmission line construction in CZ 4, 5, and 6. Fish barrier construction would permanently impact foraging habitat in CZ 6 on Bradford Island, Bacon Island, north of Woodward Island, and between Mandeville and Bradford Island. In addition, 25 acres of temporary roosting and foraging habitat, and 1,600 acres of foraging habitat would be temporarily removed (Table 12-9-31). Temporary habitat loss would primarily result from potential borrow and spoil areas (1,278 acres) and work areas for the above construction activities. The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands.

  The temporary roosting and foraging habitat that would be temporarily impacted is located on the east side of Bradford Island. The temporary roost site would be impacted by a concrete batch plant, an operable barrier work area, and a borrow and spoil area. The implementation of *AMM20 Greater Sandhill Crane* would require that all CM1 activities be designed to avoid direct loss of crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site (as described for *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

Table 12-9-32. Total Amount of Lesser Sandhill Crane Foraging Habitat Affected under Alternative 9

Foraging Habitat Value Class	Land Cover Type	CM1 Permanent (Temporary)	CM2–CM18 Permanent (Temporary)
Very high	Corn, alfalfa and alfalfa mixtures	9 (1,095)	4,083 (0)
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	2 (29)	2,058 (0)
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, non-irrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	29 (235)	2,220 (2)
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	4 (241)	3,745 (2)
None	Vineyards, orchards	0 (0)	23 (0)

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction under CM2 would result in a permanent loss of 267 acres and a temporary loss of 2 acres of lesser sandhill crane foraging habitat in CZ 2. Lesser sandhill crane use in this area is less common than in the central Delta. Construction impacts from CM2 would occur within the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration*: Based on the hypothetical tidal restoration footprint, this activity would result in the permanent loss or conversion of approximately 10,248 acres of lesser sandhill crane habitat, consisting of 41 acres of temporary roosting and foraging habitat and 10,207 acres of foraging habitat. Loss of foraging habitat from CM4 would consist of 3,642 acres of very high-value, 1,529 acres of high value, 2,040 acres of medium-value, and 2,983 acres of low-value foraging habitat (Table 12-9-32). Habitat loss would primarily occur in the Cosumnes-Mokelume River and West Delta ROAs. Tidal wetland restoration in CZ 4 could occur between the high crane use areas of the central Delta and the Cosumnes River Preserve. However, the conversion of grasslands and cultivated lands to tidal wetlands would not prohibit crane movement or reduce use of these areas. Lesser sandhill cranes are less traditional than greater sandhill cranes and would be more adaptable to changes in land use. Approximately 2,516 acres of foraging habitat would be removed within the first 10 years of Alternative 9 implementation.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees would result in the loss of 2 acres of low-value lesser sandhill crane foraging habitat (1 acre of permanent loss, 1 acres of temporary loss). This impact would occur after the first 10 years of Alternative 9 implementation.
- *CM8 Grassland Natural Community Restoration*: Approximately 300 acres of cultivated lands (foraging habitat) would be converted to grassland. No roosting/foraging habitat would be

impacted by grassland restoration activities. The restored grasslands would continue to provide foraging habitat value for the lesser sandhill crane. Approximately 257 acres would be impacted within the first 10 years of Alternative 9 implementation.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 1,350 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be expected to continue to provide roosting and foraging habitat value for the lesser sandhill crane. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat. Approximately 567 acres of habitat would be converted to nontidal marsh within the first 10 years of Alternative 9 implementation.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. The potential for these activities to result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. If new ground disturbance was necessary, sandhill crane habitat would be avoided, with the exception of a permanent loss of 4 acres of grassland foraging habitat (1 acre of which would be impacted within the first 10 years of Plan implementation).

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, impacts would be reduced by AMMs, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Potential effects would be avoided and minimized with the implementation of *AMM20 Greater Sandhill Crane*. Injury and mortality from electrical transmission facilities are described below under Impact BIO-73.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Based on current design footprints, Alternative 9 would remove 25 acres roosting and foraging habitat (temporary loss from CM1) in the study area in the near-term. In addition, 5,257 acres of foraging habitat would be removed or converted in the near-term (CM1, 1,664 acres; *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 3,906 acres would be medium- to very high-value habitat (CM1, 1,339 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 25 acres of lesser sandhill crane roosting habitat should be restored/created and 25 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 1,339 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 411 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of

40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes National Wildlife Refuge project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72, *Compensate for the Loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat*, would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 66 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 13,779 acres of foraging habitat (6% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 9,762 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective

GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes National Wildlife Refuge project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat and potential for direct mortality of this special status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration*, guided by biological goals and objectives for the species and by AMM1–AMM7*, AMM20 Greater Sandhill Crane*, which would be in place throughout the construction period, and Mitigation Measure BIO-72, which would be available to compensate for loss of medium- to very high-value foraging habitat, the effects of habitat loss and potential mortality on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Based on current design footprints, Alternative 9 would remove 25 acres roosting and foraging habitat (temporary loss from CM1) in the study area in the near-term. In addition, 5,257 acres of foraging habitat would be removed or converted in the near-term (CM1, 1,664 acres; *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration*, and *CM11 Natural Communities Enhancement and Management*—3,612 acres). Of these near-term acres of foraging habitat impacted, 3,906 acres would be medium- to very high-value habitat (CM1, 1,339 acres, CM2-11, 2,507 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 25 acres of lesser sandhill crane roosting habitat should be restored/created and 25 acres should be protected to compensate for the CM1 losses of lesser sandhill crane roosting and foraging habitat. In addition, 1,339 acres of high- to very high-value foraging habitat should be protected to mitigate the CM1 losses of lesser sandhill crane medium- to very high-value foraging habitat. The near-term effects of other conservation actions would remove 2,507 acres of medium- to very high-value foraging habitat, and therefore require 2,507 acres of protection of high- to very high-value foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of roosting and foraging habitat; 1:1 protection for the loss of foraging habitat).

The implementation of *AMM20 Greater Sandhill Crane* would require that no sandhill crane roost sites were directly impacted by CM1 covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the CM1 impact on 411 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

The BDCP has committed to near-term goals of creating 500 acres of managed wetlands and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3). These conservation actions are associated with CM3 and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Up to 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss. Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes National Wildlife Refuge project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). Mitigation Measure BIO-72 would be available to guide the near-term protection of cultivated lands to ensure that the nearterm impacts of medium- to very high-value foraging habitat for lesser sandhill crane were compensated for with appropriate crop types and natural communities.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 23,919 acres of roosting and foraging habitat and 240,475 acres of foraging habitat for lesser sandhill crane. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 66 acres of roosting and foraging habitat (less than 1% of the total habitat in the study area) and 13,779 acres of foraging habitat (6% of the total habitat in the study area) for the lesser sandhill crane during the term of the Plan. The foraging habitat lost by the late long-term timeframe would consist of 9,762 acres of medium- to very high-value foraging habitat. The locations of these losses are described above in the analyses of individual conservation measures. The implementation of *AMM20 Greater Sandhill Crane* would require that no roost sites

were directly affected by water conveyance facilities including transmission lines and associated footprints. In addition, temporarily removed habitat would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could result in the conversion of cultivated lands to grasslands.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* and *CM10 Nontidal Marsh Restoration Restoration* to restore or create at least 595 acres of greater Sandhill crane roost habitat (Objectives GSHC1.3, GSHC1.4, and GSHC1.5) and to protect at least 7,300 acres of high- to very high-value foraging habitat for greater Sandhill crane (Objective GSHC1.1). These croptypes would also provide high- to very high-value habitat for the lesser sandhill crane.

The BDCP also includes the following objectives for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Of the 500 acres of managed wetlands to be created for roosting habitat, 320 acres would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Objective GSHC1.3). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The remaining 180 acres of crane roosting habitat would be constructed within the Stone Lakes National Wildlife Refuge project boundary (BDCP Chapter 3, Figure 3.3-6) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Objective GSHC1.4). These wetlands would consist of two 90-acre wetland complexes each consisting of at least three wetlands and would be no more than 2 miles apart. The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat. Approximately 95 acres of roosting habitat would be created within 2 miles of existing permanent roost sites (Objective GSHC1.5). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, but would be sited with consideration of the location of roosting habitat loss and would be in place prior to roosting habitat loss.

The BDCP has committed to protecting 7,300 acres of high- to very high-value greater sandhill crane foraging habitat by the late long-term timeframe with at least 80% maintained in very-high value types in any given year (Objective GSHC1.1). These acres of protected foraging habitat would be located within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and would consider sea level rise and local seasonal flood events, greater Sandhill crane population levels, and the location of foraging habitat loss. The patch size of these protected lands would be at least 160 acres (Objectives GSHC1.1 and GSHC1.2). Because agricultural habitat values change over time based largely on economically driven agricultural practices, protecting crane habitat would provide enhanced stability to agricultural habitat value within the crane use area that does not currently exist. Although lesser sandhill cranes are less traditional in their use of roost sites in the Delta, these objectives for the greater sandhill crane would also benefit the lesser sandhill crane.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, in addition to Mitigation Measure BIO-72, which would compensate for the loss of medium- to very high-value foraging habitat at a ratio of 1:1, loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on lesser sandhill crane.

Mitigation Measure BIO-72: Compensate for the loss of Medium- to Very High-Value Lesser Sandhill Crane Foraging Habitat

DWR must compensate for the loss of lesser sandhill crane medium- to very high-value foraging habitat at a ratio of 1:1 by protecting or managing high- to very high-value habitat in the Plan Area. Compensation must occur prior to or concurrent with the impacts to minimize the effects of habitat loss. The crop types and natural communities that are included in foraging value categories are listed in Table 12-9-32. Foraging habitat conservation must occur within 10 kilometers of traditional sandhill crane roost sites and the location of protected habitat or conservation easements must be preapproved by CDFW.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 9 facilities. The potential mortality of greater sandhill crane in the area of the proposed transmission lines under Alternative 9 was estimated using collision mortality rates by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (methods are described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of*

Potential Bird Collisions at Proposed BDCP Powerlines). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Lesser sandhill cranes use the same roost sites as greater sandhill cranes. However, their numbers fluctuate greatly over the season as they are more mobile and use a broader landscape than greater sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

Typically, higher-voltage (230- kV) lines vary in height from 90 to 110 feet, while subtransmission (69-kV) lines vary from 50 to 70 feet (Avian Power Line Interaction Committee 2006). The Alternative 9 alignment would primarily use existing transmission and distribution lines and would require the installation of approximately 42 miles of transmission line (3 miles of 60-kV line, 38 miles of 12-kV line, and 0.5 miles of 480-V line). These lines would occur in the vicinity of Walnut Grove and adjacent to fish screen and operable barrier structures throughout the CM1 footprint. Temporary lines would be removed after construction of the water conveyance facilities, within 10 years.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. After the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 9 meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane* would substantially reduce the potential for lesser sandhill crane collisions with transmission lines. Potential measures that would eliminate this risk include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction

Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

***NEPA Effects*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 9 is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit the lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 9 would not result in an adverse effect on lesser sandhill crane.

***CEQA Conclusion*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. The current proposed transmission line alignment under Alternative 9 is not fully designed, and line locations are not final. The implementation of *AMM20 Greater Sandhill Crane* would require that the final transmission line alignment avoid crane roost sites and achieve the performance standard of no mortality of greater sandhill crane associated with the new facilities, which would also benefit lesser sandhill crane. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With incorporation of *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 9 would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of Plan Implementation on Lesser Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*). The same methods were employed to addresses the potential noise effects on cranes from Alternative 9 and to determine that as much as 1,217–5,108 acres of crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). This would include 44–157 acres of temporary crane roosting habitat and 1,173–4,951 acres of crane foraging habitat. In addition, 0–40 acres of permanent crane roosting habitat, 38–688 acres of temporary crane roosting habitat, and 1,392–7,699 acres of crane foraging habitat could be affected by noise from pile driving that would be above baseline level (50–60dBA, Table 12-9-30 under Impact BIO-71).

The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (BDCP Chapter 5, *Effects Analysis*). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (BDCP Chapter 5, *Effects Analysis*).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on lesser sandhill crane as they primarily forage on cultivated crops and invertebrates. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of CM1 implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community and floodplain restoration may indirectly affect lesser sandhill crane via uptake in lower trophic levels (see BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* (BDCP Appendix 3.C, *Avoidance and Minimization Measures*) which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Crane habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators.

Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Crane habitat could potentially be affected by general construction noise and pile driving above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators.

Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate effects on habitat, there would not be an adverse effect on lesser sandhill crane.

Tidal habitat restoration could result in increased exposure of lesser sandhill crane to selenium which could result in the potential mortality of a special-status species. This would be a significant impact. This effect would be addressed through the implementation of A*MM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Methylmercury tissue concentrations in lesser sandhill crane would not be expected to measurably increase as a result of water operations under CM1 compared to the No Action Alternative. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of lesser sandhill crane to methylmercury. This would be a significant impact. The potential indirect effects of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on lesser sandhill crane.

With AMM1–AMM7, AMM20, AMM27, and CM12 in place, the indirect effects of plan implementation under Alternative 9 would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-9-33. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit least Bell's vireo and yellow warbler (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM7).
- Maintain and enhance structural heterogeneity (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation (Objective VFRNC2.2, associated with CM7).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).
- Maintain the at least 500 acres of mature riparian forest (Objective VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (Objective VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-33. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Migratory and breeding	49	49	233	233	NA	NA
Total Impacts CM1		**49**	**49**	**233**	**233**	**NA**	**NA**
CM2–CM18	Migratory and breeding	382	656	88	109	48–85	148
Total Impacts CM2–CM18		**382**	**656**	**88**	**109**	**48–85**	**148**
TOTAL IMPACTS		**431**	**705**	**321**	**342**	**48–85**	**148**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 1,047 acres of modeled habitat (705 acres of permanent loss, 342 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-9-33). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Fremont Weir/Yolo Bypass fisheries improvements (CM2), tidal natural communities restoration (CM4), and seasonally inundated floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 282 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-9-33). Of the 282 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 49 acres would be a permanent loss and 233 acres would be a temporary loss of habitat. Most of the permanent loss would occur as wider and deeper channels are dredged in Middle River and Victoria Canal, and as operable barriers and new Sacramento River diversions are constructed in various waterways across the Delta. Temporary losses of riparian community would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. Some of this vegetation may be temporarily removed as dredging progresses, while other areas could remain in place but be temporarily affected by sedimentation and equipment movement associated with dredging.

Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least four years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the CM1 footprint. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of Yolo Bypass fisheries enhancements would permanently remove approximately 83 acres and temporarily remove 88 acres of modeled least Bell's vireo and yellow warbler habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled least Bell's vireo and yellow warbler habitat.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 28 acres and temporarily remove 21 acres of modeled least Bell's vireo and yellow warbler habitat. Based on the riparian habitat restoration assumptions, a minimum of 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions.

  The actual number of acres of valley/foothill riparian habitat that CM4 and CM5 would restore may differ from these estimates, depending on how closely the actual outcome of tidal habitat restoration approximates the assumed outcome. However, riparian restoration from CM4 and CM5 would increase the extent of least Bell's vireo and yellow warbler habitat within the study area once the restored riparian vegetation has developed habitat functions for these species.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat over the term of the BDCP. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the study area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the study area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Although least Bell's vireo nesting has not been confirmed in the study area, recent occurrences in the Yolo Bypass and at the San Joaquin River National Wildlife Refuge suggest that the reestablishment of a breeding population is a possibility over the duration of the BDCP. If present in the study area, construction -related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 752 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 282 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5]—470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 282 acres of valley/foothill riparian habitat should be restored/created and 282 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10*

Restoration of Temporarily Affected Natural Communities, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the study area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests were detected and avoided. Mitigation Measure BIO-75 would be available to address adverse effects on nesting yellow warblers.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,047 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, these species are not established breeders in the study area and impacts would likely be limited to loss of migratory habitat. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the effects of habitat loss and potential mortality on least Bell's vireo, and the effect of habitat loss on yellow warbler under Alternative 9 would not be adverse. The yellow warbler is not a species that is covered under the BDCP and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Alternative 9 would remove 752 acres of modeled habitat for least Bell's vireo and yellow warbler in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 282 acres of habitat), and implementing other conservation measures (Yolo Bypass fisheries improvements [CM2] tidal restoration [CM4], seasonally inundated floodplain restoration [CM5]—470 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for least Bell's vireo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 282 acres of valley/foothill riparian habitat should be restored/created and 282 acres should be protected to compensate for the CM1 losses of least Bell's vireo and yellow warbler habitat. The near-term effects of other conservation actions would remove 470 acres of modeled habitat, and therefore require 470 acres of restoration and 470 acres of protection of dense shrubby valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least Bell's vireo and yellow warbler. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). This restoration would provide the large contiguous patches needed for suitable least Bell's vireo and yellow warbler breeding habitat. Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These Plan objectives represent performance standards for considering the effectiveness of CM7 restoration and CM3 protection actions. biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for least Bell's vireo satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, and because least Bell's vireo and yellow warbler are not known to be established breeders in the study area, BDCP actions would not be expected to have an adverse population-level effect on either species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect yellow warblers (if they were to nest in the Plan Area over the course of the BDCP), in order to have a less than adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Mitigation Measure BIO-75 would reduce the potential impact on nesting yellow warblers to a less-than-significant impact, should they become established in the Plan Area. Considering the conservation actions described above, and AMM1–AMM-7 AMM 22, and Mitigation Measure BIO-75, Alternative 9, over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 9 would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,047 acres of habitat for these species during the term of the Plan (7% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting and migratory habitat for the least Bell's vireo and yellow warbler. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Therefore, there would be a time-lag before the restored habitat would benefit either species. However, neither species are established breeders in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,000 acres and the protection of 593 acres of habitat for the least Bell's vireo, which would also be suitable habitat for the yellow warbler.

The loss of least Bell's vireo and yellow warbler habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat for least Bell's vireo and yellow warbler. In addition, with habitat protection and restoration associated with CM3 and CM7, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place during all project activities, the impact of habitat loss and potential mortality on least Bell's vireo and the effect of habitat loss on yellow warbler under Alternative 9 would be less than significant. The yellow warbler is not a species that is covered under the BDCP. Although preconstruction surveys for least Bell's vireo may also detect nesting yellow warblers, in order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that yellow warbler nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce this potential impact on nesting yellow warblers, if present in the study area, to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.

- A qualified wildlife biologists with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors and species of special concern (except the Modesto song sparrow), and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or other birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.
- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 9 implementation would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Because there are only two recent occurrences of least Bell's vireo within the Plan Area, and no occurrences of yellow warbler breeding in the Plan Area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under CM11. Therefore, habitat fragmentation as a result of Alternative 9 would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that the transmission lines, poles, and towers are designed to avoid sensitive terrestrial habitats (including riparian) to the maximum extent feasible which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. Implementation of *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. Implementation of *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which would minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler as a result of the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of Plan Implementation on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on least Bell's vireo and yellow warbler.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least Bell's vireo and yellow warbler.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least Bell's vireo and yellow warbler from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting yellow warblers.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential adverse effects of methylmercury on least Bell's vireo and yellow warbler.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on least Bell's vireo and yellow warbler with the implementation of *AMM2 Construction Best Management Practices and Monitoring*, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least Bell's vireo or yellow warbler to methylmercury, should they begin to nest in the study area. However, it is unknown what concentrations of methylmercury are harmful to these species. Sites-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential significant impacts on least Bell's vireo and yellow warbler.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased selenium exposure would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–85 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 2. No adverse effects of increased inundation frequency on least Bell's vireo, yellow warbler, or their habitat would be expected, because riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration for *CM5 Seasonally Inundated Floodplain Restoration*, construction of setback levees could result in periodic inundation of up to 148 acres of modeled least Bell's vireo and yellow warbler habitat in CZ 7. Inundation of restored floodplains would not be expected to affect least Bell's vireo, yellow warbler, or their habitat because the breeding period is outside the period when floodplains would likely be inundated. Additionally, periodic inundation of floodplains would be expected to restore a more natural flood regime in support of riparian vegetation types that support least Bell's vireo and yellow warbler habitat. The overall effect of seasonal inundation in existing riparian natural communities would be beneficial, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic inundation would not result in an adverse effect on least Bell's vireo or yellow warbler because inundation would occur primarily during the nonbreeding season and would promote a more natural flood regime in support of habitat for these species.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of 48–85 acres (CM2) and 148 acres (CM5) of modeled habitat for least Bell's vireo and yellow warbler. However, periodic inundation would have a less-than-significant impact on least Bell's vireo or yellow warbler because inundation would occur during the nonbreeding season and would not be expected to adversely modify habitat or result in direct mortality of either species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation in existing riparian natural communities would be beneficial for least Bell's vireo and yellow warbler.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects on Suisun song sparrow and saltmarsh common yellowthroat is based on primary breeding habitat and secondary habitat. Suisun song sparrow primary breeding habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the Plan Area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable forage.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-9-34. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Full implementation of Alternative 9 also include the following conservation actions over the term of the BDCP to benefit the Suisun song sparrow and the saltmarsh common yellowthroat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11, including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1, TBEWNC1.2).

- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1)
- Protect at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4)

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *CM12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and mitigation to minimize potential effects, impacts on Suisun song sparrow and saltmarsh common yellowthroat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-34. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	0	0	0	0	NA	NA
	Secondary	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Primary	54	55	0	0	0	0
	Secondary	1,098	3,633	0	0	0	0
Total Impacts CM2–CM18		**1,152**	**3,633**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**1,152**	**3,688**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Alternative 9 conservation measures would result in would result in the permanent loss of up to 3,688 acres of Suisun song sparrow and saltmarsh common yellowthroat habitat, which would include the conversion of 55 acres of primary habitat to secondary low marsh, and the conversion of 123 acres of secondary habitat to middle or high marsh (Table 12-9-34). The only conservation measure that would affect modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat is *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation would permanently remove approximately 3,510 acres of modeled secondary Suisun song sparrow and saltmarsh common yellowthroat habitat from CZ 11 (Table 12-9-34). In addition, 55 acres of primary habitat would be converted to secondary low marsh, and 123 acres of secondary habitat would be converted to middle or high marsh. Most areas proposed for removal would be managed wetlands that serve as relatively marginal habitat for Suisun song sparrow and saltmarsh common yellowthroat, which primarily use brackish tidal wetlands. Approximately 2% of primary habitat for these species would be converted to foraging habitat. Full implementation of CM4 would restore or create at least 6,000 acres of tidal brackish emergent wetland natural community in CZ 11, which would be expected to support Suisun song sparrow and saltmarsh common yellowthroat habitat. It is expected that restoring tidal wetland communities that are self-sustaining and not reliant on ongoing management actions necessary to maintain the existing managed wetland habitats would better ensure the long-term viability of these populations. Furthermore, effects of tidal habitat restoration on sparrow and yellowthroat abundance and distribution would be monitored, and the restoration of tidal habitat would be sequenced and located in a manner that minimizes effects on occupied habitats until functional habitats were restored (see BDCP Chapter 3, Section 3.4.5, *CM4 Tidal Natural Communities Restoration*, and Section 3.6, *Adaptive Management and Monitoring Program*).

- *CM11 Natural Communities Enhancement and Management:* Control of nonnative Suisun song sparrow and saltmarsh common yellowthroat predators, if deemed necessary, would be expected to reduce predation loss of nests and, consequently, increase and maintain the abundance of Suisun song sparrow and saltmarsh common yellowthroat in restored tidal habitats over the term of the BDCP. Habitat management- and enhancement-related activities could disturb Suisun song sparrow or saltmarsh common yellowthroat nests if they are located near work sites. The potential for these activities to have an adverse effect on Suisun song sparrow would be avoided and minimized through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. A variety of *CM11 Natural Communities Enhancement and Management* habitat management actions that are designed to enhance wildlife values in restored and protected tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of Suisun song sparrow and saltmarsh common yellowthroat habitat in CZ 11. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available species' habitat.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect Suisun song sparrow and saltmarsh common yellowthroat use of the surrounding habitat in Suisun. Maintenance activities could include vegetation management, and levee repair. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Construction-related activities could result in nest destruction or disturbance resulting in mortality of eggs and nestlings if restoration activities took place within the nesting period for these species. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize these potential effects on Suisun song sparrow. Mitigation

Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on saltmarsh common yellowthroat. Grading, filling, contouring, and other initial ground-disturbing operations during restoration activities could temporarily fragment existing modeled tidal brackish emergent wetland habitat for Suisun song sparrow and saltmarsh common yellowthroat which could temporarily reduce the extent and functions of the affected habitat. These temporary effects would be minimized through sequencing of restoration activities and through *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Under Alternative 9, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 58 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to compensate for the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the Plan Area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1, BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the adverse effect of construction activities on nesting saltmarsh common yellowthroat.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 9 as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of Suisun song sparrow and saltmarsh common yellowthroat habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM4, with the management and enhancement actions (CM11), and with the incorporation of the additional measures in the biological goals and objectives, guided by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on Suisun song sparrow would not be adverse, and the effects of habitat loss and conversion on saltmarsh common yellowthroat would not be adverse under Alternative 9. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order for the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Under Alternative 9, there would be no impacts resulting from the construction of the water conveyance facilities (CM1). However, there would be a permanent loss of 1,040 acres of modeled secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat in the study area in the near-term. In addition, 54 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to mid to high marsh, which would provide primary nesting habitat for these species. Although there would be a temporal lag in these conversions, there would be no net loss of primary habitat in the near-term. These effects would result from implementing *CM4 Tidal Natural Communities Restoration* and would all occur in Suisun Marsh in CZ 11.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities that would be affected and that are identified in the biological goals and objectives for Suisun song sparrow in Chapter 3 of the BDCP would be 1:1 for restoration/creation of tidal brackish emergent habitat. Using this ratio would indicate that 1,152 acres of tidal brackish emergent wetland should be restored/created to mitigate the near-term losses of Suisun song sparrow and saltmarsh common yellowthroat habitat.

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal brackish emergent wetland and 4,800 acres of managed wetland in the Plan Area. These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Suisun song sparrow and saltmarsh common yellowthroat. The tidal brackish emergent wetland would be restored in CZ 11 among the Western Suisun/Hill Slough Marsh Complex, the Suisun Slough/Cutoff Slough Marsh Complex, and the Nurse Slough/Denverton Marsh complex (Objective TBEWNC1.1, BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TBEWNC1.4). Portions of the 4,800 acres of managed wetland would benefit both the Suisun song sparrow and the saltmarsh common yellowthroat through the enhancement of degraded areas to provide dense native vegetation, which is required for nesting sites, song perches, and refuge from predators. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat. The acres of restoration and protection contained in the near-term Plan goals, and the incorporation of the additional measures in the biological goals and objectives (BDCP Chapter 3) would be sufficient to mitigate the near-term effects of tidal restoration.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The saltmarsh common yellowthroat is not a species that is covered under the BDCP. Although preconstruction surveys for Suisun song sparrow would likely also detect nesting saltmarsh common yellowthroat, in order to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the impact of construction activities on nesting saltmarsh common yellowthroat to a less-than-significant level.

Because the number of acres required to meet the typical mitigation ratio described above would be only 3,590 acres of restored/created tidal natural communities, the 6,000 acres of tidal brackish and tidal freshwater emergent wetland restoration and the 4,100 acres of managed wetland protection and enhancement contained in the near-term Plan goals, and the additional detail in the biological objectives for Suisun song sparrow, are more than sufficient to support the conclusion that the near-term impacts of habitat loss and direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 3,722 acres of primary and 23,986 acres of secondary habitat for Suisun song sparrow and saltmarsh common yellowthroat. Alternative 9 as a whole would result in the permanent loss of 3,688 acres of habitat (15% of the total habitat in the study area) from the implementation of *CM4 Tidal Natural Communities Restoration*. Within this habitat loss, 55 acres of primary habitat would be converted to secondary foraging habitat, and 123 acres of secondary habitat would be converted to primary habitat.

The Plan includes a commitment through *CM4 Tidal Natural Communities Restoration* to restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 (Objective TBEWNC1.1) These tidal wetlands would be restored as a mosaic of large, interconnected and biologically diverse patches, and at least 1,500 acres of restored marsh would consist of middle-and high-marsh vegetation with dense, tall stands of pickleweed and bulrush cover, serving as primary habitat for Suisun song sparrow and saltmarsh common yellowthroat (Objective TBEWNC1.2). In addition, grasslands adjacent to restored tidal brackish emergent wetlands would be protected or restored, to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation. This adjacent upland habitat would provide high tide refugia during high tide events, after sea-level rise has converted the lower-level grasslands to tidal natural communities. Tidal wetlands would be restored in a mosaic of large, interconnected and biologically diverse patches. Larger and more interconnected patches of suitable habitat would be expected to reduce the effects of habitat fragmentation that currently exist in Suisun marsh in CZ 11. Nonnative predators would be controlled as needed to reduce nest predation and to help maintain species abundance (CM11). Restoration would be sequenced over the term of the Plan and occur in a manner that would minimize any temporary, initial loss and fragmentation of habitat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 1,500 acres of primary habitat and 4,500 acres of secondary habitat in addition to the protection of 384 acres of secondary habitat for Suisun song sparrow, which would also benefit the saltmarsh common yellowthroat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The saltmarsh common yellowthroat is not a covered species under the BDCP. Although preconstruction surveys for Suisun song sparrow may detect nesting saltmarsh common yellowthroat, in order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that saltmarsh common yellowthroat nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce this potential impact on nesting saltmarsh common yellowthroat to a less-than-significant level.

Considering Alternative 9's restoration provisions, which would replace low-value secondary habitat with high-value tidal brackish emergent habitat, including both foraging and primary habitat, and provide upland refugia for Suisun song sparrow and saltmarsh common yellowthroat, the acreages of restoration would be sufficient to mitigate habitats lost to construction and restoration activities. Loss of habitat or direct mortality through implementation of Alternative 9, with the implementation of AMM1–AMM7, AMM22, and Mitigation Measure BIO-75, AMM1–AMM7 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-81: Indirect Effects of Plan Implementation on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

Indirect Construction-Related Effects: If Suisun song sparrow or saltmarsh common yellowthroat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Suisun song sparrow and saltmarsh common yellowthroat habitat adjacent to restoration work areas could be affected by such disturbances, which could temporarily result in diminished use of habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect either species. If construction occurred during the nesting season, these indirect effects could result in the loss or abandonment of nests and mortality of any eggs and/or nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of Suisun song sparrow and saltmarsh common yellowthroat by requiring preconstruction surveys and, if nests are present, the establishment of a no-disturbance buffer within 250 feet of a nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Salinity: Water conveyance facilities operations would have an effect on salinity gradients in Suisun Marsh; however, these effects cannot be reasonably disaggregated from effects resulting from tidal habitat restoration. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water conveyance facilities operations and operations of salinity control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more saline environments, which should have a beneficial effect on Suisun song sparrow and saltmarsh common yellowthroat because their historical natural Suisun Marsh habitat is brackish tidal marsh. However, the degree to which salinity changes in all tidal channels and sloughs in and around Suisun Marsh would be highly variable.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Although tidal habitat restoration might increase methylation of mercury export to other habitats, restoration is unlikely to significantly increase the exposure of Suisun song sparrow or saltmarsh common yellowthroat to methylmercury, as they currently reside in tidal marshes where elevated methylmercury levels exist. Robinson et al. (2011) found toxic levels of methylmercury levels in song sparrow populations from southern San Francisco Bay, although populations near Suisun Marsh (i.e., San Pablo and Simas Creeks) were much lower. The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. The Suisun Marsh Plan anticipates that restored tidal wetlands would generate less methylmercury than the existing managed wetlands to be restored (Bureau of Reclamation et al. 2010).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Suisun song sparrow and saltmarsh common yellowthroat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Suisun song sparrow and saltmarsh common yellowthroat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Suisun song sparrow and saltmarsh common yellowthroat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances would not have an adverse effect on Suisun song sparrow with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects of noise and visual disturbance on saltmarsh common yellowthroat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills, and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Implementation of Operational Scenario A, including operation of salinity-control gates, and tidal habitat restoration would be expected to increase water salinity in Suisun Marsh, which would be expected to establish tidal marsh similar to historic conditions. Tidal habitat restoration is unlikely to have a substantial impact on Suisun song sparrow and saltmarsh common yellowthroat through increased exposure to methylmercury, as these species currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion**:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring*.

Changes in salinity gradients would be expected to have a beneficial impact on Suisun song sparrow and saltmarsh common yellowthroat through the establishment of tidal marsh similar to historic conditions. The implementation of tidal natural communities restoration (CM4) is unlikely to significantly increase the exposure of Suisun song sparrow or saltmarsh common yellowthroat to methylmercury, as they currently reside in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

Tidal habitat restoration could result in increased exposure of Suisun song sparrow and saltmarsh common yellowthroat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With these avoidance and minimization measures and Mitigation Measure BIO-75 in place, indirect effects of Alternative 9 implementation would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the Plan Area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the Plan Area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the plan area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

***NEPA Effects*:** The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 9 would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat

Swainson's Hawk

The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-9-35. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it would take years (for foraging habitat) and 1 or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the Swainson's hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).

- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Conserve at least 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat (Objective SH1.1, associated with CM3).
- Protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Of the 42,275 acres of cultivated lands protected as Swainson's hawk foraging habitat under Objective SH1.2, up to 1,500 acres can occur in CZs 5 and 6, and must have land surface elevations greater than −1 foot NAVD88 (Objective SH1.3, associated with CM3).
- Protect at least 10,750 acres of grassland, vernal pool, and alkali seasonal wetland as Swainson's hawk foraging habitat (Objective SH1.4, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk* to minimize potential effects, impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-35. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	32	32	29	29	NA	NA
	Foraging	373	373	2,534	2,534	NA	NA
Total Impacts CM1		**405**	**405**	**2,563**	**2,563**	**NA**	**NA**
CM2–CM18	Nesting	252	412	54	85	41–70	189
	Foraging	8,903	48,511	504	1,540	3,025–6,635	8,008
Total Impacts CM2–CM18		**9,155**	**48,923**	**558**	**1,625**	**3,066–6,705**	**8,197**
Total Nesting		**284**	**444**	**83**	**114**	**41–70**	**189**
Total Foraging		**9,276**	**48,884**	**3,038**	**4,074**	**3,025–6,635**	**8,008**
TOTAL IMPACTS		**9,560**	**49,328**	**3,121**	**4,188**	**3,066–6,705**	**8,197**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term

LLT = late long-term

NA = not applicable

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 53,516 modeled habitat (558 acres of nesting habitat and 52,958 acres of foraging habitat) for Swainson's hawk (Table 12-9-35). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 61 acres of Swainson's hawk nesting habitat (32 acres of permanent loss and 29 acres of temporary loss). In addition, 2,907 acres of foraging habitat would be removed (373 acres of permanent loss, 2,534 acres of temporary loss, Table 12-9-35). Activities that would impact modeled Swainson's hawk habitat include channel dredging, intakes, fish barriers, access roads, and construction of transmission lines. Permanent losses of nesting habitat would primarily consist of channel enlargement at the Sacramento River and Meadows Slough. Temporary losses would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. The riparian habitat in these areas is composed of very small patches or stringers bordering waterways, which include valley oak and scrub vegetation. Permanent impacts on foraging habitat would occur from the construction of the canals in CZ 8 east and south of Clifton Court Forebay and other conveyance structures in CZ 4, 5, 6, 7, and 8. Temporary impacts would primarily occur from borrow and spoil areas and temporary work areas. Impacts on foraging habitat would include the permanent loss of 1 acres and the temporary loss of 727 acres of very high-value alfalfa (Table 12-9-36). The CM1 permanent construction footprint overlaps with 3 Swainson's hawk occurrences. Canal construction overlaps with two occurrences and channel dredging, instream island dredging, and a potential spoil area overlap with one occurrence. Thirteen Swainson's hawk occurrences overlap with the temporary construction footprint for CM1. These impacts would consist of potential borrow and spoil areas (3 occurrences), access road work areas (8 occurrences), and work areas for dredging, a barge facility, and a siphon (one occurrence). *AMM18 Swainson's Hawk* would require preconstruction surveys and the establishment of a no-disturbance buffer and minimize potential effects of construction on nesting Swainson's hawks. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

Table 12-9-36. Acres of Impacted Swainson's Hawk Foraging Habitat by Value Classes

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	CM1 Permanent (temporary)	CM2-18 permanent (temporary)
Very high	Alfalfa hay	114 (727)	13,898 (432)
Moderate	Irrigated pasture, other hay crops, tomatoes, grain crops (wheat, barley, oats), fallow fields	145 (225)	15,136 (477)
Low	Other irrigated field and truck crops, dry pasture, grasslands, alkali seasonal wetlands, vernal pool complex, sudan	87 (907)	10,535 (349)
Very low	Safflower, sunflower, corn, grain sorghum, managed wetlands	27 (674)	8,943 (281)

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 133 acres of nesting habitat (79 acres of permanent loss, 54 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,500 acres of foraging habitat would be removed (996 acres of permanent loss, 554 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the

Sacramento Weir would also remove Swainson's hawk habitat. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 295 acres of Swainson's hawk nesting habitat and 37,359 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. Impacts on foraging habitat from CM4 would consist of 10,757 acres of very high-value (alfalfa), 11,706 acres of moderate-value, and 7,973 acres of low-value habitat (See Table 12-9-36 for land cover types classified by habitat value). Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. However, the conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM4, suggesting that numerous nest sites could be directly affected by inundation from tidal restoration activities.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 69 acres of Swainson's hawk nesting habitat (38 acres of permanent loss, 31 acres of temporary loss) and 2,856 acres of foraging habitat (1,820 acres of permanent loss, 1,036 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 953 acres of Swainson's hawk foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7. There are at least 27 Swainson's hawk nest sites that overlap with the hypothetical restoration areas for CM7.

- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of Swainson's hawk agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of Swainson's hawk foraging habitat value.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 1,440 acres of Swainson's hawk foraging habitat in CZ 2 and CZ 4. Small patches of riparian vegetation that support Swainson's hawk nesting habitat may develop along the margins of restored nontidal marsh if appropriate site conditions are present.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of Swainson's hawk grassland foraging habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of Swainson's hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

  Permanent and temporary nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 9 would remove 367 acres (284 permanent, 83 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 12,314 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 2,907 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 61 acres of nesting habitat should be restored/created and 61 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 2,907 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1) A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller)

within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (five gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 9 would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 558 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 52,958 acres of foraging habitat (11% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration,* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian

restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1–4, 7–9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of Swainson's hawk habitat and potential direct mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on Swainson's hawk under Alternative 9 would not be adverse.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 9 would remove 367 acres (284 permanent, 83 temporary) of Swainson's hawk nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 61 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—306 acres). In addition, 12,314 acres of Swainson's hawk foraging habitat would be removed or converted in the near-term (CM1, 2,907 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,407 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected and those that are identified in the biological goals and objectives for Swainson's hawk in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 61 acres of nesting habitat should be restored/created and 61 acres should be protected to compensate for the CM1 losses of Swainson's hawk nesting habitat. In addition, 2,907 acres of foraging habitat should be protected to mitigate the CM1 losses of Swainson's hawk foraging habitat. The near-term effects of other conservation actions would remove 306 acres of modeled nesting habitat, and therefore require 306 acres of restoration and 306 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would remove 9,407 acres of modeled foraging habitat, and therefore require 9,407 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 restoration and 1:1 protection for the loss of nesting habitat; 1:1 protection for the loss of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM5, CM7, and CM8, and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small

but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in very high- and high-value crop types for Swainson's hawk (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide high-value habitat for Swainson's hawk. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Swainson's hawk foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Swainson's hawk nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the Plan Area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk within the Plan Area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that are incorporated into the riparian restoration would not be clustered in a single region of the Plan Area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk.

Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. With this program in place, Alternative 9 would not have a substantial adverse effect on Swainson's hawk in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 558 acres of potential nesting habitat (6% of the potential nesting habitat in the study area) and 52,958 acres of foraging habitat (11% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration,* and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. The distribution and abundance of potential Swainson's hawk nest trees would be

increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1). In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for Swainson's hawk and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SH2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for Swainson's hawks as prey species recolonize the fields (Objective MWNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. Foraging habitat would be conserved at a ratio of 1:1 (Objective SH1.1) and at least 42,275 acres of cultivated lands that provide Swainson's hawk foraging habitat would be protected by the late long-term, 50% of which would be in very high-value habitat production in CZs 1–4, 7–9, and 11 (Objective SH1.2).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM18 Swainson's Hawk*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Swainson's hawk.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. This species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the Plan Area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

***NEPA Effects*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

***CEQA Conclusion*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of Plan Implementation on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other conservation measures could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. These construction activities would include water conveyance construction, tidal restoration activities, floodplain restoration, and Fremont Weir/Yolo Bypass Enhancements. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with BDCP actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

CEQA Conclusion: Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 3,066–6,706 acres of modeled Swainson's hawk habitat (consisting of approximately 41–70 acres of nesting habitat and 3,025–6,635 acres of foraging habitat; Table 12-9-35). However, project-associated inundation of areas that would not otherwise have been inundated would be expected to occur in no more than 30% of all years, since Fremont Weir is expected to overtop the remaining estimated 70% of all years, and during those years notch operations would not typically affect the maximum extent of inundation. In more than half of all years under Existing Conditions, an area greater than the project-related inundation area already inundates in the bypass. Therefore, habitat conditions in the bypass would not be expected to change substantially as a result of Yolo Bypass operations. However, increased duration of inundation during years of Fremont Weir operation, may delay the period for which foraging habitat is available to Swainson's hawks by up to several weeks.

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 8,197 acres of modeled Swainson's hawk habitat (Table 12-9-35), consisting of 189 acres of nesting and 8,008 acres of foraging habitat. Floodplain restoration would be expected to restore a more natural flood regime and sustain riparian vegetation types that support regeneration of Swainson's hawk nesting habitat. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more). Foraging habitat that is inundated after Swainson's hawks arrive in the Central Valley in mid-March could result in a periodic loss of available foraging habitat due to the reduction in available prey. Inundated habitats would be expected to recover following draw-down and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic and short term effect that is unlikely to affect Swainson's hawk distribution and abundance, or foraging use of the study area.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Although foraging habitat would be periodically unavailable to Swainson's hawk, inundated habitats are expected to recover following draw down. This would be considered a short-term effect that would not have a significant impact on Swainson's hawk.

Tricolored Blackbird

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on tricolored blackbird. The habitat model used to assess effects on tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although breeding colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass and along the southwestern perimeter of the study area, breeding colonies are uncommon in the study area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the study area. The foraging component includes land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the Plan Area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of tricolored blackbird modeled habitat as indicated in Table 12-9-37. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the tricolored blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect and manage at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11. (Objective TRBL1.1).

- Protect at least 26,300 acres of moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, 50% of which is of high or very high value (Objective TRBL1.2).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11. At least 1,000 acres of this habitat would be within 5 miles of the nesting habitat protected under Objective TRBL1.1 (Objective TRBL1.3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-37. Changes in Tricolored Blackbird Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]		Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	Nesting	8	8	2	2	NA	NA
		Foraging - cultivated	230	230	293	293	NA	NA
		Foraging - noncultivated	55	55	71	71	NA	NA
	Non-breeding	Roosting	58	58	198	198	NA	NA
		Foraging - cultivated	36	36	1,334	1,334	NA	NA
		Foraging - noncultivated	28	28	273	273	NA	NA
Total Impacts CM1			**415**	**415**	**2,171**	**2,171**		
CM2–CM18	Breeding	Nesting	13	72	75	77	11–26	30
		Foraging - cultivated	1,657	9,525	84	359	1,837–2,598	2,124
		Foraging noncultivated	704	1,991	155	184	600–1,689	355
	Non-breeding	Roosting	570	1,642	0	1	0–4	29
		Foraging - cultivated	3,747	23,955	54	420	222–1,057	2,506
		Foraging - noncultivated	459	1,341	0	3	42–191	158
Total Impacts CM2–CM18			**7,150**	**38,526**	**368**	**1,044**		
Total Breeding			**2,667**	**11,881**	**623**	**991**		
Total Nonbreeding			**4,898**	**27,060**	**1,859**	**2,229**		
TOTAL IMPACTS			**7,565**	**38,941**	**2,482**	**3,220**		

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 9 conservation measures would result in the permanent and temporary loss combined of up to 12,872 acres of modeled breeding habitat and up to 29,289 acres of modeled nonbreeding for tricolored blackbird (Table 12-9-37). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the permanent loss of 293 acres of tricolored blackbird breeding habitat (8 acres nesting habitat, 230 acres of cultivated lands, and 55 acres of noncultivated lands suitable for foraging) and 122 acres of nonbreeding habitat (58 acres roosting habitat, 36 acres of cultivated lands, and 28 acres of noncultivated lands suitable for foraging; Table 12-9-37). In addition, CM1 would result in the temporary removal of 366 acres of breeding habitat (2 acres nesting habitat, 293 acres of cultivated lands, and 71 acres of noncultivated lands suitable for foraging) and 1,805 acres of nonbreeding habitat (198 acres roosting habitat, 1,334 acres of cultivated lands, and 273 acres of noncultivated lands suitable for foraging, Table 12-9-37). Habitat that would be lost is located in the central Delta, in CZs 4, 5, 6, 7, and 8. There are no occurrences of tricolored blackbird that overlap with the construction footprint for CM1. However, records exist throughout the study area. The implementation of *AMM21 Tricolored Blackbird* would require preconstruction surveys and the establishment of nodisturbance buffers and would minimize potential effects on nesting tricolored blackbirds (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Construction of CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction activity associated with fisheries improvements in the Yolo Bypass would permanent loss of 595 acres of tricolored blackbird breeding habitat (13 acres nesting habitat, 477 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 8 acres of nonbreeding habitat (consisting entirely of roosting habitat). In addition, CM2 construction would result in the temporary removal of 314 acres of breeding habitat (75 acres nesting habitat, 84 acres of cultivated lands, and 155 acres of noncultivated lands suitable for foraging) and 54 acres of nonbreeding habitat (consisting entirely of cultivated lands). The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 3,937 acres of tricolored blackbird breeding habitat (21 acres of nesting, 2,814 acres of cultivated lands, and 1,102 acres of noncultivated lands suitable for foraging) and 10,794 acres of nonbreeding habitat (1,633 acres of roosting, 18,489 acres of cultivated lands, and 672 acres of noncultivated lands suitable for foraging). An estimated 13,692 acres of the 28,424 acres to be permanently lost would be expected to convert to tidal emergent wetland communities that could provide nonbreeding season roosting habitat for tricolored blackbirds, depending on future vegetation density and composition. Conversion would result in the loss of an estimated 4,316 acres of tricolored blackbird breeding habitat (34 acres of nesting habitat; plus 3,635 acres of cultivated lands and 647 acres of noncultivated habitats suitable for foraging) and 9,375 acres of nonbreeding habitat (8,716 acres of cultivated lands and 659 acres of noncultivated habitats suitable for foraging). These habitat losses and conversions would occur in CZs 1, 2, 4, 5, 6, 7, 8, and 11. Although considered to be a permanent loss, due to the uncertainty of the quantity of restored suitable habitat, any areas that develop into riparian scrub-shrub could provide suitable nesting and roosting habitat for tricolored blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction and riparian restoration associated with floodplain restoration in the south Delta (CZ 7) would result in the permanent removal of up to 554 acres of tricolored blackbird breeding habitat (4 acres of nesting habitat, 503 acres of cultivated lands, and 47 acres of noncultivated habitats suitable for foraging) and 656 acres of nonbreeding habitat (1 acre of roosting habitat, 652 acres of cultivated lands, and 3 acres of noncultivated habitats suitable for foraging) in CZ 7. Patches of riparian scrub associated with the restoration of approximately 1,000 acres of valley/foothill riparian habitat managed as early- to mid-successional habitats (as a component of CM5) could provide suitable nesting, roosting or foraging habitat for tricolored blackbird once these restored habitats have developed habitat functions for the species.

- *CM8 Grassland Natural Communities Restoration*: Restoration of grassland would result in the permanent removal of 1,521 acres of tricolored breeding habitat and 210 acres of nonbreeding habitat. Grassland restoration would be implemented on cultivated lands and would therefore result in the conversion of tricolored blackbird cultivated foraging habitat to high-value grassland foraging habitat in CZs 2, 4, and 5.

- *CM10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 568 acres of tricolored blackbird breeding habitat and 945 acres of nonbreeding habitat (all cultivated lands suitable for foraging). About two-thirds of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide low-value roosting habitat for tricolored blackbird depending on vegetation density and composition.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 43.5 acres of breeding habitat and 6.5 acres of nonbreeding habitat (all grassland suitable for foraging) would be lost as a result of construction of trails and facilities. Impacts from recreational-related facilities that would occur within the first 10 years of Alternative 9 implementation would include a loss of 13 acres of breeding habitat.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of tricolored blackbird grassland foraging habitat in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 250 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 3,290 acres of breeding habitat (98 acres of nesting, 2,264 acres of cultivated lands, and 985 acres of noncultivated lands suitable for foraging) and 6,757 acres of nonbreeding habitat (826 acres of roosting, 5,171 acres of cultivated lands, and 760 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 659 acres of breeding, 1,927 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain*

Restoration, CM7 Riparian Natural Community Restoration—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 10 acres of restoration and 10 acres of protection of nesting habitat, 256 acres of restoration and 256 acres of protection of roosting habitat, 854 acres of protection of noncultivated lands that provide foraging habitat, 523 acres of protection of cultivated lands suitable for foraging during the breeding season, and 1,370 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season. using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 98 acres of restoration and 98 acres of protection for nesting habitat, 826 acres of restoration and 826 acres of protection for roosting habitat, 3,490 acres of protection of noncultivated foraging habitat, 2,264 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 5,171 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-9-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage, and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in an adverse effect on tricolored blackbird.

Table 12-9-38. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies	Corn, sunflower, millet, alfalfa and mixed alfalfa, mixed pasture, native pasture, induced high water table native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grass pasture, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Wheat, mixed grain and hay, farmsteads	Wheat, oats, mixed grain and hay, farmsteads
Marginal	Rice	None
None	All remaining crop types	All remaining crop types

[a] Generally March through August; occasional breeding in fall (September through November).

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP, Chapter 5, *Effects Analysis*). Alternative 9 as a whole would result in the permanent loss of and temporary effects on 12,872 acres of breeding habitat and 29,289 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (8% of the total breeding habitat in the study area and 11% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-9-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The losses of tricolored blackbird habitat and potential direct mortality of a special status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM4, CM5, CM7, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM7 and *AMM21 Tricolored Blackbird*, which would be in place throughout the construction period, the effects of habitat loss or potential mortality 9on tricolored blackbird would not be adverse under Alternative 9.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 3,290 acres of breeding habitat (98 acres of nesting, 2,264 acres of cultivated lands, and 985 acres of noncultivated lands suitable for foraging) and 6,757 acres of nonbreeding habitat (826 acres of roosting, 5,171 acres of cultivated lands, and 760 acres of noncultivated lands suitable for foraging) for tricolored blackbird in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 659 acres of breeding, 1,927 acres of nonbreeding), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*, and *CM7 Riparian Natural Community Restoration*—2,688 acres of breeding, 4,830 acres of nonbreeding).

Typical NEPA and CEQA project-level mitigation ratios would be 1:1 for restoration/creation and 1:1 for protection for the loss of nesting and roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Using these ratios would indicate that the compensation for loss or conversion of tricolored blackbird habitat from CM1 would require 10 acres of restoration and 10 acres of protection of nesting habitat, 256 acres of restoration and 256 acres of protection of roosting habitat, 854 acres of protection of noncultivated lands that provide foraging habitat, 523 acres of protection of cultivated lands suitable for foraging during the breeding season, and 1,370 acres of cultivated lands that provide foraging habitat during the nonbreeding season. The near-term effects of other conservation actions would remove or convert 88 acres of nesting habitat, 570 acres of roosting habitat, 619 acres of noncultivated lands suitable for foraging, 1,741 acres of cultivated lands that provide foraging habitat during the breeding season, and 3,801 acres of cultivated lands during the nonbreeding season. Compensation for these losses from other conservation measures would therefore require 88 acres of restoration and 88 acres of protection of nesting habitat, 570 acres of restoration and 570 acres of protection of roosting habitat, 1,238 acres of protection of noncultivated lands that provide foraging habitat, 1,741 acres of protection of cultivated lands suitable for foraging during the breeding season, and 3,801 acres of cultivated lands that provide foraging habitat during the nonbreeding season. using the same typical NEPA and CEQA ratios.

Total compensation for near-term loss or conversion of tricolored blackbird required using the typical ratios above would be 98 acres of restoration and 98 acres of protection for nesting habitat, 826 acres of restoration and 826 acres of protection for roosting habitat, 3,490 acres of protection of noncultivated foraging habitat, 2,264 acres of protection for cultivated lands that provide foraging habitat during the breeding season, and 5,171 acres of cultivated lands that provide foraging habitat during the nonbreeding season.

The BDCP has committed to near-term goals of protecting 25 acres and restoring protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, restoring 8,850 acres of tidal freshwater emergent wetlands and 2,000 acres of tidal brackish emergent wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM5, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses. Some proportion of these natural communities provide suitable habitat for tricolored blackbird as described below.

Nesting by tricolored blackbirds is currently limited by the availability of high-value breeding habitat, which is represented by suitable nesting substrate, such as cattail/bulrush emergent wetland, in close association with highly productive foraging areas that support abundant insect prey, such as grasslands, seasonal wetlands, pasturelands, alfalfa and other hay crops, and some croplands. The nesting habitat would be located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (see Table 12-9-38 for foraging habitat values) and would be actively managed to maintain actively growing stands of bulrush/cattail emergent vegetation through mechanical habitat manipulation, prescribed fire, or other measures described in *CM11 Natural Communities Enhancement and Management*. In addition to the actively managed nesting habitat, a portion of the 750 acres of protection and 800 acres of restoration of valley/foothill riparian natural community, and the restoration of 900 acres nontidal marsh would provide nesting habitat for tricolored blackbird. The Plan estimates that modeled nesting habitat in the Plan Area currently includes 8% of valley/foothill riparian and 22% of nontidal freshwater emergent marsh (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, approximately 64 acres of valley foothill riparian and 198 acres of nontidal marsh restored would provide nesting habitat for tricolored blackbird.

The Plan estimates that modeled roosting habitat in the Plan Area currently includes 95% of tidal freshwater emergent wetland, 57% of brackish emergent wetland, 21% of valley/foothill riparian, 75% of nontidal marsh, and 15% of managed wetlands (BDCP Chapter 5, Section 5.6.12.2, *Beneficial Effects*). Assuming similar proportions of modeled habitat on conservation lands restored in the near-term, the restoration of approximately 8,408 acres of tidal freshwater emergent wetland, 1,140 acres of tidal brackish emergent wetland, 675 acres of nontidal marsh, and 168 acres of valley foothill riparian would provide 10,391 acres of nesting habitat for tricolored blackbird. An estimated 878 acres of roosting habitat would also be protected in the near-term time period (158 acres of valley/foothill riparian, 720 acres managed wetland).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) which would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities. The protection and restoration of grasslands, alkali seasonal wetlands, and vernal pool complexes would provide improved foraging opportunities for tricolored blackbirds during both the breeding and nonbreeding seasons. Proximity of nesting colonies to suitable foraging habitat contributes to high reproductive success in tricolored blackbirds. These natural communities are known to support large insect populations, a vital food resource for successful rearing and fledging of young. Those conservation lands that lie within a few miles of active nesting colonies would provide high-value foraging areas to support breeding tricolored blackbirds. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, further enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,600 acres of potential foraging habitat for tricolored blackbird in the near-term (Objective CLNC1.1). Objective TRBL1.3 commits to protecting 11,050 acres (23% of the total cultivated lands commitment) of high- to very high-value breeding-foraging habitat by the late long-term. Assuming that lands would be protected proportional to the conservation objectives for covered species, approximately 3,588 acres of high- to very high-value breeding foraging habitat consisting of cultivated lands would be protected in the near-term. These lands would be protected within 5 miles of occupied or recently occupied tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8 or 11. In addition, Objective TRBL1.2 states that of the cultivated lands protected in the late long-term time period, 26,300 acres (54% of all cultivated lands protected) would be maintained in moderate – high, or very high-value cultivated lands, at least 50% of which would be high- to very high-value. Assuming proportional conservation in the near-term, an estimated 8,424 acres of cultivated lands that provide foraging habitat for tricolored blackbird would be protected in the near-term, 4,212 of which would be in high- to very high-value cultivated lands. Small but essential habitats for species including tricolored blackbird would also be protected that occur within the agricultural matrix. This would include the retention of wetlands, grassland patches, shrub stands, and herbaceous edge habitats, which could provide suitable nesting, foraging or roosting habitat for tricolored blackbird (Objective CLNC1.3).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The acres of protection and restoration contained in the near-term Plan goals, in addition to the detailed habitat value goals that would be applied to near-term acres, are more than sufficient to satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the near-term impacts from other conservation measures on nesting, roosting, and cultivated lands foraging habitat. The 3,660 acres of grassland protection in the near-term are 213 acres short of the 2:1 protection mitigation ratio. However, the acres of permanent impact would be compensated for by this acreage, and temporary impacts on grassland would be restored to preproject conditions (including revegetation with native vegetation if within 1 year of completion of construction) under *AMM2 Construction Best Management Practices and Monitoring*. With the enhancement of grasslands described above, and the restoration of temporary habitat impacts, this difference between impacted and conserved grassland acreages in the near-term time period would not result in a significant impact on tricolored blackbird.

Late Long-Term Timeframe

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area (BDCP, Chapter 5, *Effects Analysis*). Alternative 9 as a whole would result in the permanent loss of and temporary effects on 12,872 acres of breeding habitat and 29,289 acres of nonbreeding habitat for tricolored blackbird during the term of the Plan (8% of the total breeding habitat in the study area and 11% of the total nonbreeding habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

Species-specific biological goals and objectives for tricolored blackbird commit to protecting or restoring at least 50 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 5 miles of high-value foraging habitat in CZs 1, 2, 8, or 11 (Objective TRBL1.1). Foraging habitat value classes for tricolored blackbird are found in Table 12-9-38. To ensure that natural community conservation benefits tricolored blackbird, the Plan further specifies that cultivated lands protected for tricolored blackbird retain residual wetland, grassland patches, shrub stands, and herbaceous edge habitats which may provide suitable nesting, foraging or roosting habitat for the species (Objective CLNC1.3). In addition, 26,300 acres of moderate-, high-, or very high-value cultivated lands would be conserved and managed as nonbreeding foraging habitat, 50% of which would be of high- or very high-value (Objective TRBL1.2). At least 11,050 acres of cultivated lands managed as high to very high breeding foraging habitat would be conserved within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.2). Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the study area, so the loss is not expected to adversely affect the population in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6.12.2, *Effects Analysis*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 46,566 acres of tricolored blackbird habitat (16,476 acres breeding habitat and 31,090 acres nonbreeding habitat) and restoration of 31,001 acres of tricolored blackbird habitat (2,190 acres breeding habitat and 28,811 acres nonbreeding habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 9 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Other factors relevant to effects on tricolored blackbird are listed here.

- Very little loss of nesting habitat would occur (up to 84 acres of permanent loss and 88 acres of temporary loss).
- Most of the loss of breeding and nonbreeding habitat would be to cultivated lands that are abundant throughout the Plan Area, so the loss is not expected to adversely affect the population in the Plan Area.

- Most temporary impacts would be to cultivated lands and grasslands that could be restored relatively quickly to suitable foraging habitat after completion of construction activities.

Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*, the loss of habitat or direct mortality though the implementation of Alternative 9 as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on tricolored blackbird.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area. Although migratory movements

and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the Plan Area currently poses these risks, and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane*contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on tricolored blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily during daily flights between roosting and foraging sites and during winter during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 9 would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird

Impact BIO-89: Indirect Effects of Plan Implementation on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1.900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 250 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony or nest site. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury.

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*. Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM26, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM26, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1-7, AMM21, AMM27, and CM12 in place, the indirect effects of Alternative 9 implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 2,447–4,312 acres of breeding habitat and 263–1,252 acres of nonbreeding habitat (Table 12-9-37). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 2,509 acres of breeding habitat (30 acres of nesting, 2,124 acres of cultivated lands, 355 acres of noncultivated lands suitable for foraging) and 2,694 acres of nonbreeding habitat(29 acres of roosting, 2,506 acres of cultivated lands, 158 acres of noncultivated lands suitable for foraging, Table 12-9-37) resulting in the temporary loss of these habitats. Tricolored blackbirds are highly nomadic during the winter and would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat. There would be no expected adverse effect on tricolored blackbird.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would not result in an adverse effect on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for tricolored blackbird. Periodic inundation would have a less-than-significant impact on tricolored blackbird because inundation is expected to take place outside of the breeding season. Although foraging habitat would be temporarily unavailable, tricolored blackbirds are highly nomadic in winter and wintering birds would be expected to move to adjacent foraging habitat.

Western Burrowing Owl

Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-9-39. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the western burrowing owl (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 1,000 acres of cultivated lands in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 mile of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1, associated with CM3).

- Protect at least 8.000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands and vernal pool complex in CZs 1, 8, and/or 11 to achieve no net loss of wetted acres (Objectives ASWNC1.2 and VPNC1.2, associated with CM9).
- Increase burrow availability and prey abundance and accessibility (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, VPNC2.5, GNC2.3, and GNC2.4, associated with CM11).
- Protect at least 48,600 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species and maintain and protect the small patches of important wildlife habitats associated with cultivated lands (Objectives CLNC1.1 and CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-39. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	87	87	407	407	NA	NA
	Low-value	298	298	2,120	2,120	NA	NA
Total Impacts CM1		**385**	**385**	**2,527**	**2,527**	**NA**	**NA**
CM2–CM18	High-value	4,487	11,570	245	328	1,390–3,303	779
	Low-value	3,527	28,506	144	971	1,522–2,927	6,162
Total Impacts CM2–CM18		**8,014**	**40,076**	**389**	**1,299**	**2,912–6,230**	**6,941**
Total High-value		**4,574**	**11,657**	**652**	**735**		
Total Low-value		**3,825**	**28,804**	**2,264**	**3,091**		
TOTAL IMPACTS		**8,399**	**40,461**	**2,916**	**3,826**		

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 44,287 acres of modeled habitat for western burrowing owl (of which 12,392 acres is of high value and 31,895 acres is of low value, Table 12-9-39). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 494 acres of acres of modeled high-value western burrowing owl habitat (87 acres of permanent loss, 407 acres of temporary loss) from CZs 4, 5, 6, 7, and 8. In addition, 2,418 acres of low-value burrowing owl habitat would be removed (298 acres of permanent loss, 2,120 acres of temporary loss). The permanent and temporary losses to habitat would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. The CM1 footprint does not overlap with any western burrowing owl occurrences. However, there is suitable habitat throughout the study area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,127 acres of high-value western burrowing owl habitat (882 acres of permanent loss, 245 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 242 acres of low-value habitat would be removed (98 acres of permanent loss, 144 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 29,668 acres of modeled western burrowing owl habitat in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. The majority of removed or converted acres (19,739 acres) is composed of low-value habitat. However, 9,929 acres of high-value habitat would also be lost from tidal restoration actions. Tidal restoration would directly impact and fragment remaining high-value grassland habitat just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Tidal natural community restoration efforts would impact one extant record of burrowing owl just northeast of Oakley along Dutch Slough and one possibly extirpated record in Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,504 acres of modeled western burrowing owl in CZs 2, 4, and 7. This total is comprised of

2,279 acres of low-value habitat. Also, 225 acres of high-value grassland habitat would be removed (142 permanent, 83 temporary) consisting of small patches of habitat along the San Joaquin, Old, and Middle Rivers in CZ 7.

- *CM6 Channel Margin Enhancement*: Sites for channel margin enhancement would be located along levees where western burrowing owl could be present. The species is known to use often the grassland edges along canals and levees in agricultural areas. The implementation of *AMM23 Western Burrowing Owl* would reduce the potential for channel margin enhancement activities to disturb owls or affect active nests.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 11 acres of high-value burrowing owl habitat as part of tidal restoration. In addition, 960 acres of low-value habitat would be removed as a part of tidal restoration and 3,991 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration*: Grassland restoration would primarily be implemented on agricultural lands and would result in the permanent loss of 1,676 acres (362 acres of high-value and 1,314 acres of low-value) of western burrowing owl habitat. The conversion of 1,676 acres of low-value habitat to high-value grassland, would temporarily remove available habitat but would ultimately have a beneficial effect on the western burrowing owl.

- *CM10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 159 acres of high-value and 952 acres of low-value western burrowing owl habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* into the BDCP which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value western burrowing owl habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 5,226 acres (4,574 acres permanent, 652 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 494 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 7,373 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,120 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 988 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 4,836 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4

in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on western burrowing owl habitat. Some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include high-value crop types. These acres, in addition to the management and enhancement activities that are contained in the Plan goals, would satisfy the typical mitigation ratios that would be applied to the other near-term conservation actions, providing that the 15,400 acres of cultivated lands protected in the near-term were managed in suitable crop types to compensate for the loss of high-value habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for the Near-Term Loss of High-Value Burrowing Owl Habitat,* would be available to address the adverse effect of high-value habitat loss in the near-term. The acres of protection of cultivated lands would be sufficient to compensate for the loss of low-value burrowing owl habitat from CM1 and from the other near-term conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM23 Western Burrowing Owl*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 12,392 acres of high-value habitat and 31,895 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since

been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of western burrowing owl habitat and potential mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM23 Western Burrowing Owl,* and with the implementation of Mitigation Measure BIO-91, *Compensate For the Near-Term Loss of High-Value Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss and potential mortality on western burrowing owl would not be adverse under Alternative 9.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 5,226 acres (4,574 acres permanent, 652 acres temporary) of high-value habitat for western burrowing owl in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 494 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—4,732 acres). In addition, 7,373 acres of low-value habitat would be removed or converted in the near-term (CM1, 2,120 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—3,671 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. A proportion of the loss of low-value habitat would result from conversion and enhancement to high-value habitats. Using these typical ratios would indicate that 988 acres should be protected to compensate for the loss of high-value habitat from CM1 and that 4,836 acres should be protected to compensate for the loss of low-value habitat from CM1. The near-term effects of other conservation actions would require 9,464 acres of protection to compensate for the loss of high-value habitat and 3,671 acres of protection to compensate for the loss of low-value habitat using the same typical NEPA and CEQA ratios (2:1 protection for the loss of high-value habitat, 1:1 protection for the loss of low-value habitat).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

The protection of high-value grasslands is essential in order to sustain existing western burrowing owl populations in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the study area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3). These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on western burrowing owl habitat. Some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include high-value crop types. These acres, in addition to the management and enhancement activities that are contained in the Plan goals, would satisfy the typical mitigation ratios that would be applied to the other near-term conservation actions, providing that the 15,400 acres of cultivated lands protected in the near-term were managed in suitable crop types to compensate for the loss of high-value habitat at a ratio of 2:1. Mitigation Measure BIO-91, *Compensate for the Near-Term Loss of High-Value Burrowing Owl Habitat,* would reduce the significant effect of high-value habitat loss in the near-term. The acres of protection of cultivated lands would be sufficient to compensate for the loss of low-value burrowing owl habitat from CM1 and from the other near-term conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM23 Western Burrowing Owl*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 12,392 acres of high-value habitat and 31,895 acres of low value habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide habitat for western burrowing owl and reduce the effects of current levels of habitat fragmentation. This protection would not only expand the amount of protected high-value habitat in the Plan Area, but also support existing western burrowing owl populations that occur to the west of CZ 8 and in the areas surrounding CZs 1 and 11, which would especially benefit declining populations in the vicinity of Suisun Marsh and San Pablo Bay. Certain types of cultivated lands such as irrigated pasture, alfalfa and other hay crops, and some row crops can provide foraging habitat for western burrowing owl. Under appropriate management regimes, cultivated lands can support breeding and wintering burrowing owls. To ensure that cultivated lands conservation benefits western burrowing owl, the Plan's biological goals and objectives further specify that, of the cultivated lands protected in the late long-term, at least 1,000 acres would be protected in CZs 1 and 11 that support high-value burrowing owl habitat and are within 0.5 miles of high-value grassland habitat or occupied low-value habitat (Objective WBO1.1). Under *CM11 Natural Communities Enhancement and Management*, small mammal and insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). In addition, burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning, Objectives ASWNC2.3, VPNC2.4, GNC2.3).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the protection of an estimated 33,766 acres of western burrowing owl habitat (8,589 acres high-value and 25,177 acres low-value habitat) and restoration of 1,645 acres of western burrowing owl habitat (1,642 acres high-value and 3 acres low-value habitat).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM23 Western*

Burrowing Owl, and Mitigation Measure BIO-91, *Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the loss of habitat and direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western burrowing owl.

Mitigation Measure BIO-91: Compensate for Near-Term Loss of High-Value Western Burrowing Owl Habitat

Because the BDCP lacks an acreage commitment for specific crop types that would be managed within the 15,400 acres of cultivated lands protected in the near-term time period, DWR will compensate for the loss of high-value burrowing owl habitat with high-value natural communities or cultivated crop types a ratio of 2:1 in the near-term time period.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given its physical and behavioral characteristics (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*) New transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of Plan Implementation on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of modeled habitat adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with the implementation of *AMM23 Western Burrowing Owl* into the BDCP. AMM23, would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

NEPA Effects: Indirect effects on western burrowing owl as a result of Alternative 9 implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects from Alternative 9 implementation would not be adverse under NEPA.

CEQA Conclusion: Indirect effects on western burrowing owl as a result of Alternative 9 implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 9 implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,390–3,303 acres of high-value habitat and 1,522–2,927 acres of low-value habitat (Table 12-9-39).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 6,941 acres of modeled habitat (6,162 acres, of which would be low-value foraging habitat; Table 12-9-39).

Burrowing owls cannot use inundated areas for foraging or nesting, and increased inundation frequency and duration of cultivated lands and grassland habitats may affect prey populations that have insufficient time to recover following inundation events. Depending on timing, seasonal inundation of western burrowing owl habitat could result in displacement from nesting burrows or drowning of individuals. The potential for this effect is considered low because suitable burrow sites would most likely be located along setback levees, which are expected to be subject to inundation less frequently than floodplain surfaces that would be less likely to support suitable nesting burrows.

NEPA Effects: The periodically inundated habitat would not be expected to have an adverse effect on the population. The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation; therefore, the potential impact would not be adverse.

CEQA Conclusion: The potential for direct mortality of western burrowing owl caused by inundation would be low because the locations of burrows would likely be above elevations consistently subject to inundation. Therefore, periodic inundation would be expected to have a less-than-significant impact on the population.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on the western yellow-billed cuckoo. The habitat model for western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 25 acres, and migratory habitat, which includes the same plant alliances as breeding habitat without the minimum 25 acres patch size requirement.

The western yellow-billed cuckoo is uncommon in the study area at present, and the likelihood that it would be found using the modeled habitat (Table 12-9-40) is low relative to more abundant riparian species. Nesting of the species in the study area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of western yellow-billed cuckoo modeled habitat as indicated in Table 12-9-40. Full implementation Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the western yellow-billed cuckoo (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain at least 500 acres of mature riparian forest in CZ 4 or CZ 7 (Objective VFRNC2.3, associated with CM3 and CM7).

- Maintain the 500 acres of mature riparian forest (VFRNC2.3) intermixed with a portion of the early- to mid-successional riparian vegetation (VFRNC2.2) in large blocks with a minimum patch size of 50 acres and minimum width of 330 feet (Objective VFRNC2.4, associated with CM3 and CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-40. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Breeding	14	14	12	12	NA	NA
	Migratory	30	30	205	205	NA	NA
Total Impacts CM1		**44**	**44**	**217**	**217**	**NA**	**NA**
CM2–CM18	Breeding	29	142	5	10	11–20	17
	Migratory	278	383	83	94	37–64	125
Total Impacts CM2–CM18		**307**	**525**	**88**	**104**	**48–84**	**142**
Total Breeding		**43**	**156**	**17**	**22**	**11–20**	**17**
Total Migratory		**308**	**413**	**288**	**299**	**37–64**	**125**
TOTAL IMPACTS		**351**	**569**	**305**	**321**	**48–84**	**142**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 890 acres of modeled habitat for western yellow-billed cuckoo (178 acres of breeding habitat, 712 acres of migratory habitat; Table 12-9-40). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 26 acres of breeding habitat (14 acres of permanent loss, 12 acres of temporary loss) and 235 acres of migratory habitat (30 acres of permanent loss, 205 acres of temporary loss) for western yellow-billed cuckoo (Table 12-9-40). Permanent losses would primarily consist of channel enlargement at the Sacramento River and Meadows Slough. Temporary losses would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. The riparian habitat in these areas is composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no extant occurrences of yellow-billed cuckoo nests in the study area. However, this loss would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the loss of approximately 31 acres of breeding habitat (26 acres of permanent loss and 5 acres of temporary loss) and 140 acres of migratory habitat (57 acres of permanent loss and 83 acres of temporary loss) for yellow-billed cuckoo in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 9 implementation. There are no extant occurrences of yellow-billed cuckoo nesting in the study area.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 110 acres of modeled yellow-billed cuckoo breeding habitat and 310 acres of modeled migratory habitat in CZ 1, 2, 6, and 11. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove. These detections do not overlap with the hypothetical restoration areas for CM4.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 11 acres of modeled yellow-billed cuckoo breeding habitat (6 acres of permanent loss and 5 acres of temporary loss) and 27 acres of migratory habitat (16 acres of permanent loss and 11 acres of temporary loss) in CZ 7. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support western yellow-billed cuckoo habitat once the riparian vegetation has developed habitat functions for the cuckoo.

- *CM11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat over the term of the BDCP. With conditions favorable for its future establishment in the study area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. *CM11 Natural Communities Enhancement and Management* actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values over the term of the BDCP.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection in 2009 in DHCCP surveys (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the present of suitable habitat indicates that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 656 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 261 acres of modeled breeding and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled breeding and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 261 acres of valley/foothill riparian habitat should be restored/created and 261 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the study area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 890 acres of modeled habitat (7% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objective VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat associated with Alternative 9 would represent an adverse effect in the absence of other conservation actions. The species is not an established breeder in the study area and current presence is limited to migrants. In addition, the habitat lost would consist of small, fragmented riparian stands that would not provide high-value habitat for the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality under Alternative 9 on western yellow-billed cuckoo would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 656 acres of modeled habitat for yellow-billed cuckoo in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 261 acres of modeled breeding and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—395 acres of modeled breeding and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-billed cuckoo in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 261 acres of valley/foothill riparian habitat should be restored/created and 261 acres should be protected to compensate for the CM1 losses of yellow-billed cuckoo habitat. The near-term effects of other conservation actions would remove 395 acres of modeled habitat, and therefore require 395 acres of restoration and 395 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-billed cuckoo. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts. However, the restored riparian habitat would require several years (early-mid successional) and several decades (mature riparian forest), for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Because the western yellow-billed cuckoo is not known to be an established breeder in the study area, the time lag in riparian restoration from BDCP actions would not be expected to have an adverse population-level effect on the species. Overall, BDCP riparian habitat restoration actions would be expected to benefit western yellow-billed cuckoo by increasing opportunities for a breeding population to become reestablished in the study area.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 890 acres of modeled habitat (7% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). In addition, at least 500 acres of mature riparian forest would be maintained in CZ 4 or CZ 7(Objective VFRNC2.3). This mature, riparian forest would be mixed with a portion of the early- to mid-successional riparian vegetation in large blocks with a minimum patch size of 50 acres and a minimum width of 330 feet (Objectives VFRNC2.2 and VFRNC2.4), which would provide suitable nesting habitat for the cuckoo. The protection of 750 acres of existing valley/foothill riparian forest in CZ 7 would not provide in its entirety the vegetative structure needed to support these species, because patch sizes may not be large enough to support yellow-billed cuckoo breeding habitat. However, a portion of the protected habitat would provide suitable habitat for the species. Restoration actions through CM7 and CM11 would expand the patches of existing riparian forest in order to support the species should they become established breeders in the study area.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,397 acres and the protection of 517 acres of habitat for the yellow-billed cuckoo.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Pla*n, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In the absence of other conservation actions, effects on western yellow-billed cuckoo from Alternative 9 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species; however, considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a, minimal effect on the species.

NEPA Effects: Fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo. The habitat functions in the study area for the species would be greatly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area, it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors,

which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. Because there is low probability for the species to occur in the study area, any increased risk of predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

NEPA Effects: The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increased risk in predation on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, any increased risk in predation on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of Plan Implementation on Western Yellow-Billed Cuckoo

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction BMPs and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: Western yellow-billed cuckoo modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Cuckoos are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on western yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the western yellow-billed cuckoo. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on western yellow-billed cuckoo.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on western yellow-billed cuckoo from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Alternative 9 implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality. Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects would not have an adverse effect on western yellow-billed cuckoo.***CEQA Conclusion***: Indirect effects on western yellow-billed cuckoo as a result of Alternative 9 implementation could have a significant impact on the species from modification of habitat. Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the western yellow-billed cuckoo foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into the BDCP, indirect effects as a result of Alternative 9 implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 11–20 acres of modeled western yellow-billed cuckoo breeding habitat and 37–64 acres of modeled migratory habitat. No adverse effects of increased inundation frequency on western yellow-billed cuckoo or its habitat are expected because the cuckoo breeding period is outside the period the weir would be operated. In addition, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 142 acres of modeled western yellow-billed cuckoo habitat (17 acres of breeding habitat, 125 acres of migratory habitat). Inundation of restored floodplains is not expected to affect western yellow-billed cuckoo or its habitat adversely because the cuckoo breeding period is outside the period the floodplains would likely be inundated, and periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for western yellow-billed cuckoo. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for western yellow-billed cuckoo, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Periodic effects of inundation would not have an adverse on yellow-billed cuckoo if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on yellow-billed cuckoos if they were to establish as breeders in the study area, because flooding is expected to occur outside of the breeding season.

White-Tailed Kite

The habitat model used to assess impacts on white-tailed kite includes breeding habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen et al. 1995).

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-9-41. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed Kite*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 9 would also include the following biological objectives over the term of the BDCP to benefit the white-tailed kite (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Protect at least 8,000 acres of grassland with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30- foot-wide hedgerows along fields and roadsides to promote prey populations throughout protected cultivated lands (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-41. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	43	43	89	89	NA	NA
	Foraging	374	374	2,542	2,542	NA	NA
Total Impacts CM1		**417**	**417**	**2,631**	**2,631**		
CM2–CM18	Nesting	312	507	88	121	48–82	230
	Foraging	8,723	52,675	516	1,484	3,030–6,651	7,402
Total Impacts CM2–CM18		**9,035**	**53,182**	**604**	**1,605**	**3,078–6,733**	**7,632**
Total Nesting		**355**	**550**	**177**	**210**	**48–82**	**230**
Total Foraging		**9,097**	**53,049**	**3,058**	**4,026**	**3,030–6,651**	**7,402**
TOTAL IMPACTS		**9,452**	**53,599**	**3,235**	**4,236**	**3,078–6,733**	**7,632**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 57,835 acres of modeled habitat for white-tailed kite (760 acres of nesting habitat, 57,075 acres foraging habitat; Table 12-9-41). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian habitat restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 132 acres of white-tailed kite nesting habitat (43 acres of permanent loss and 89 acres of temporary loss). In addition, 2,916 acres of foraging habitat would be removed (374 acres of permanent loss, 2,542 acres of temporary loss, Table 12-9-41). Activities that would impact modeled White-tailed kite habitat include channel dredging, intakes, fish barriers, access roads, and construction of transmission lines. Permanent losses of nesting habitat would primarily consist of channel enlargement at the Sacramento River and Meadows Slough. Temporary losses would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. The riparian habitat in these areas is composed of very small patches or stringers bordering waterways, which include valley oak and scrub vegetation. Permanent impacts on foraging habitat would occur from the construction of the canals in CZ 8 east and south of Clifton Court Forebay and other conveyance structures in CZs 4, 5, 6, 7, and 8. Temporary impacts would primarily occur from borrow and spoil areas and temporary work areas. The CM1 footprint does not overlap with any occurrences of white-tailed kite. However, the implementation of *AMM39 White-Tailed Kite* would minimize effects on white-tailed kites if they were to nest within or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 1,525 acres of foraging habitat would be removed (1,008 acres of permanent loss, 516 acres of temporary loss). Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove white-tailed kite habitat. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 383 acres of white-tailed kite nesting habitat and 41,625 acres of foraging habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce the local nesting population.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of white-tailed kite nesting habitat (42 acres of permanent loss, 33 acres of temporary loss) and 2,675 acres of foraging habitat (1,706 acres of permanent loss, 968 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 971 acres of white-tailed kite foraging habitat as part of tidal restoration and 3,991 acres as part of seasonal floodplain restoration through CM7.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,849 acres of white-tailed kite agricultural foraging habitat to grassland foraging habitat in CZs 1, 2, 4, 5, 7, 8, and 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of white-tailed kite foraging habitat value.
- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh (CM10) would result in the permanent conversion of 1,440 acres of cultivated lands to nontidal marsh in CZ 2 and CZ 4. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.
- *CM11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of white-tailed kite grassland foraging habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-white-tailed kite foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Plan implementation.

  Permanent and temporary white-tailed kite nesting habitat losses from the above conservation measures, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM39 White-Tailed Kite* in addition to conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged white-tailed kite if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM39 White-Tailed Kite* into the BDCP.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 9 would remove 532 acres (355 acres of permanent loss, 177 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 132 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 12,155 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 2,916 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 132 acres of nesting habitat should be restored/created and 132 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 2,916 acres should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for restoration and 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2, BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and

other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. With this program in place, Alternative 9 would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 760 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 57,075 acres of foraging habitat (11% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration, and CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite habitat and potential direct mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM39 White-Tailed Kite*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on white-tailed kite under Alternative 9 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effect of construction would be less than significant under CEQA. Alternative 9 would remove 532 acres (355 acres of permanent loss, 177 acres of temporary loss) of white-tailed kite nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 132 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres). In addition, 12,155 acres of white-tailed kite foraging habitat would be removed or converted in the near-term (CM1, 2,916 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*—9,239 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for white-tailed kite in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 132 acres of nesting habitat should be restored/created and 132 acres should be protected to mitigate the CM1 losses of white-tailed kite nesting habitat. In addition, 2,916 acres should be protected to compensate for the CM1 losses of white-tailed kite foraging habitat. The near-term effects of other conservation actions would remove 400 acres of modeled nesting habitat, and therefore require 400 acres of restoration and 400 acres of protection of nesting habitat. Similarly, the near-term effects of other conservation actions would result in the loss or conversion of 9,239 acres of modeled foraging habitat, and therefore require 9,239 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting habitat; 1:1 for restoration and 1:1 for protection of foraging habitat).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM8 and would occur in the same timeframe as the construction and early restoration losses.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on white-tailed kite foraging habitat, as well as mitigate the near-term effects of the other conservation measures.

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and

other near-term impacts on white-tailed kite nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kites. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. With this program in place, Alternative 9 would not have a substantial adverse effect on white-tailed kite in the near-term timeframe, either through direct mortality or through habitat modifications. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 760 acres of potential nesting habitat (5% of the potential nesting habitat in the study area) and the loss or conversion of 57,075 acres of foraging habitat (11% of the foraging habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM5 Seasonally Inundated Floodplain*

Restoration, CM7 Riparian Natural Community Restoration, and *CM8 Grassland Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*).

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for the species. White-tailed kite is excluded from narrow bands of riparian vegetation by Swainson's hawks and therefore requires wide patches of nesting habitat where its range overlaps with Swainson's hawk. The distribution and abundance of potential white-tailed kite nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1). In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide foraging habitat for white-tailed kite and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) that dry during the spring would also serve as foraging habitat for white-tailed kite as prey species recolonize the fields (Objective MWNC1.1). In addition, the restoration of at least 65,000 acres of tidal natural communities, including transitional uplands would provide high-value foraging habitat for the white-tailed kite. At least 45,405 acres of cultivated lands that provide foraging habitat for white-tailed kite would be protected by the late long-term time period (Objective CLNC1.1).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 3,800 acres and the protection of 570 acres of nesting habitat and the restoration of 49,875 acres and the protection of 2,050 acres of foraging habitat for white-tailed kite.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In the absence of other conservation actions, the effects on white-tailed kite habitat from Alterative 9 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special status species; however, considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian and foraging habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. In particular, 95% of the loss of foraging habitat effects involve the conversion from one habitat type to another form of suitable foraging habitat. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on white-tailed kite.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of bird strike mortality from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on white-tailed kite.

CEQA Conclusion: The construction and presence of new transmission lines would not represent a significant impact because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would eliminate or nearly eliminate the risk of mortality from bird strike for white-tailed kite as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of Plan Implementation on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM39 White-Tailed Kite* would require preconstruction surveys, and if detected, 200-yard no-disturbance buffers would be established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Increased methylmercury associated with natural community and floodplain restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on white-tailed kite.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect white-tailed kite use of the surrounding habitat. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 9 would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7 and *AMM39 White-Tailed Kite.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM26, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 9 implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 9 would have a less-than-significant impact on white-tailed kite with the implementation of *AMM39 White-Tailed Kite*, and AMM1–AMM7. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM26, Selenium Management* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 9 implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (related to *CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 48–82 acres of modeled white-tailed kite nesting habitat and 3,030–6,651 acres of modeled white-tailed kite foraging habitat (Table 12-9-41). During inundation years, affected cultivated lands and grassland would not be available as foraging habitat until prey populations have re-inhabited inundated areas. This would result in temporary periodic reduction in availability of foraging habitat. If late-season Fremont Weir operations were to preclude the planting of some crop types, there could be a further loss of foraging habitat value if the crop type that would have been planted would provide greater foraging habitat value than the fallowed fields. No known white-tailed kite nest sites would be affected, and increased periodic flooding is not expected to cause any adverse effect on nest sites that may be within the inundation area because existing trees already withstand floods in the area, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and any nest sites would be located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to approximately 230 acres of modeled white-tailed kite nesting habitat and 7,402 acres of modeled white-tailed kite foraging habitat (Table 12-9-41). Inundation of foraging habitat could result in a periodic reduction of available foraging habitat due to the reduction in available prey. Following draw-down, inundated habitats are expected to recover and provide suitable foraging conditions until the following inundation period. Thus, this is considered a periodic impact that is unlikely to affect white-tailed kite distribution and abundance, or foraging use of the study area.

Periodic inundation of floodplains (through CM2 and CM5) would be expected to restore a more natural flood regime in support of riparian vegetation types that support white-tailed kite nesting habitat. No adverse effects of inundation on white-tailed kite riparian habitat are expected because valley/foothill riparian vegetation is expected to benefit from seasonal inundation.

***NEPA Effects*:** Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would not result in an adverse effect.

***CEQA Conclusion*:** Although foraging habitat would be periodically unavailable to white-tailed kite because of CM2 and CM5 implementation, inundated habitats are expected to recover following draw-down. Any effects are considered short-term and would be expected to have a less-than-significant impact on white-tailed kite.

Yellow-Breasted Chat

Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking. For this reason, the effects analysis only provides the breakdown between primary and secondary habitat in the habitat loss totals and associated tables, and does not provide this breakdown in the text by activity or effect type.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-9-42. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit the yellow-breasted chat (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).

- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM7).
- Maintain at least 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM7).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-42. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Nesting and Migratory Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Primary	31	31	63	63	NA	NA
	Secondary	18	18	171	171	NA	NA
	Suisun Marsh/ Upper Yolo Bypass	0	0	0	0	NA	NA
Total Impacts CM1		**49**	**49**	**234**	**234**	**NA**	**NA**
CM2–CM18	Primary	96	214	58	73	19–38	92
	Secondary	209	357	0	6	6–18	56
	Suisun Marsh/ Upper Yolo Bypass	76	85	29	29	23–32	0
Total Impacts CM2–CM18		**381**	**656**	**87**	**108**	**48–88**	**148**
Total Primary		**127**	**245**	**121**	**136**		
Total Secondary		**227**	**375**	**171**	**177**		
Total Suisun Marsh/Upper Yolo Bypass		**76**	**85**	**29**	**29**		
TOTAL IMPACTS		**430**	**705**	**321**	**342**		

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 1,047 acres of modeled habitat for yellow-breasted chat (Table 12-9-42). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 283 acres of modeled yellow-breasted chat habitat (94 acres of primary nesting habitat, 189 acres of secondary habitat) from CZs 4, 5, 6, 7, and 8 (Table 12-9-42). Most of the permanent loss would occur as wider and deeper channels are dredged in Middle River and Victoria Canal, and as operable barriers and new Sacramento River diversions are constructed in various waterways across the Delta. Temporary losses of habitat would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. Some of this vegetation may be temporarily removed as dredging progresses, while other areas could remain in place but be temporarily affected by sedimentation and equipment movement associated with dredging. The CM1 construction footprint overlaps with 6 occurrences of yellow-breasted chat. Six occurrences detected on inchannel islands (south of Mildred Island) intersect with temporary dredging work areas, and 3 intersect with a temporary operable barrier work area on north Mandeville Island. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize potential effects on nesting yellow-breasted chat in the study area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove approximately 83 acres and temporarily remove 88 acres of yellow-breasted chat habitat in the Yolo Bypass in CZ 2. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 545 acres of modeled yellow-breasted chat habitat in CZ 1, 2, 6, and 11. This total is composed of an estimated 182 acres of primary nesting and migratory habitat, 349 acres of secondary nesting and migratory habitat, and 14 acres of nesting and migratory habitat in the Suisun Marsh and upper Yolo Bypass areas.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 49 acres of modeled yellow-breasted chat habitat in CZ 7. This total is comprised of 28 acres of primary nesting and migratory habitat and 21 acres of secondary nesting and migratory habitat. Based on the riparian habitat restoration assumptions, approximately 3,000 acres of valley/foothill riparian habitat would be restored as a component of seasonally inundated floodplain restoration actions. The actual number of acres that would be restored may differ from these estimates, depending on how closely the outcome of seasonally inundated floodplain restoration approximates the assumed outcome. Once this restored riparian vegetation has developed habitat functions, a portion of it would be suitable to support yellow-breasted chat habitat.

- *CM11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat over the term of the BDCP. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the study area.

  Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

  Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values over the term of the BDCP.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.

- Permanent and temporary habitat losses from the above CMs, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 751 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 283 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter 3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 283 acres of valley/foothill riparian habitat should be restored/created and 283acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have an adverse population-level effect on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,047 acres of modeled habitat (7% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the study area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of yellow-breasted chat habitat and potential direct mortality of this special-status species would represent an adverse effect in the absence of other conservation actions. The restored riparian habitat would require 5 years to several decades for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, the habitat that would be lost consists of small, fragmented riparian stands that do not provide high-value habitat for the species. And because the nesting and migratory habitat that would be lost is small relative to the species range throughout California and North America, BDCP actions would not be expected to have an adverse population-level effect on the species. With habitat protection and restoration associated with CM3, CM7, and CM11, guided by biological goals and objectives and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on yellow-breasted chat under Alternative 9 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the impact of construction would be less than significant under CEQA. Alternative 9 would remove 751 acres of modeled habitat for yellow-breasted chat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 283 acres of modeled nesting and migratory habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—468 acres of modeled nesting and migratory habitat). These habitat losses would primarily consist of small, fragmented riparian stands in CZ 2-CZ 8 that do not provide high-value habitat for the species.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 and that are identified in the biological goals and objectives for yellow-breasted chat in Chapter

3 of the BDCP would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 283 acres of valley/foothill riparian habitat should be restored/created and 283acres should be protected to compensate for the CM1 losses of yellow-breasted chat habitat. The near-term effects of other conservation actions would remove 468 acres of modeled habitat, and therefore require 468 acres of restoration and 468 acres of protection of valley/foothill riparian using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community in the study area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM7 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on yellow-breasted chat. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Goals and objectives in the Plan for riparian restoration also include the restoration, maintenance and enhancement of structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of conservation actions for the species.

The acres of protection contained in the near-term Plan goals and the additional detail in the biological objectives for yellow-breasted chat satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures. The restored riparian habitat could require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, because the modeled habitat impacted largely consists of small patches of blackberry, willow, and riparian scrub, BDCP actions would not be expected to have a significant population-level impact on the species in the near-term time period.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,047 acres of modeled habitat (7% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities (CM1) and from *CM2 Yolo Bypass Fisheries Enhancement, CM4 Tidal Natural Communities Restoration, and CM5 Seasonally Inundated Floodplain Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

The Plan includes conservation commitments through *CM7 Riparian Natural Community Restoration* and *CM3 Natural Communities Protection and Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian woodland. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). The yellow-breasted chat has specific structural habitat requirements, so only the early- to mid-successional portions of the restored and protected riparian natural would be expected to provide suitable habitat characteristics for the species. Fluvial disturbance in restored riparian floodplains would help to maintain early- to mid-successional vegetation. The resulting riparian systems would be subject to natural erosion and deposition, which would provide conditions conducive to the establishment of dense willow stands that are preferred by yellow-breasted chat for nesting. In addition, if monitoring determined that cowbird parasitism was having an effect on the yellow-breasted population in the study area, a cowbird control program would be implemented through *CM11 Natural Communities Enhancement and Management*. Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable habitat for yellow-breasted chat.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 2,683 acres and the protection of 594 acres of habitat for the yellow-breasted chat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In the absence of other conservation actions, the effects on yellow-breasted chat habitat from Alternative 9 would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. Considering these protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-breasted chat.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Because of the current infrequent occurrence and small numbers of yellow-breasted chat in the Plan Area, and because *CM5 Seasonally Inundated Floodplain Restoration* would restore and protect contiguous high-value riparian habitat in CZ 7, any such habitat fragmentation is expected to have no or minimal effect on the species.

NEPA Effects: Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. The habitat functions for the species would be significantly improved through the implementation of CM5, which would restore and protect large contiguous patches of riparian habitat.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions will be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the Plan Area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of Plan Implementation on Yellow-Breasted Chat

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP, which would ensure 250 foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, reducing the use of an estimated 59 acres of modeled primary nesting and migratory habitat and 119 acres of secondary nesting and migratory habitat. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect on the species.

Methylmercury Exposure: Yellow-breasted chat modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances in Suisun Marsh. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. Chats are a top predator in the benthic food chain; they forage by probing their beaks into the mud (Zembal and Fancher 1988) and prey primarily on mussels, spiders, seeds and hulls of cordgrass, and insects (Eddleman and Conway 1998).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009).

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of mercury. Concentrations of methylmercury known to be toxic to bird embryos have been found in the eggs of San Francisco Bay clapper rails (Schwarzbach and Adelsbach 2003); however, currently, it is unknown how much of the sediment-derived methylmercury enters the food chain in Suisun Marsh or what tissue concentrations are actually harmful to the yellow-breasted chat. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). In Suisun Marsh, the conversion of managed wetlands to tidal wetlands is expected to result in an overall reduction in mercury methylation. Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-breasted chat.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-breastede chat from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the BDCP.

Restoration actions that would create tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the yellow-breasted chat foodweb to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the conversion of managed wetlands to tidal wetlands in Suisun Marsh would be expected to reduce the overall production of methylmercury, resulting in a net benefit to species. Implementation of CM12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased exposure to selenium would be less than significant.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–88 acres of modeled yellow-breasted chat nesting and migratory habitat. No adverse effects of increased inundation frequency on yellow-breasted chat or its habitat are expected because the chat breeding period is outside the period the weir would be operated. Moreover, riparian vegetation supporting habitat has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation would be within the tolerance of these vegetation types.

Based on hypothetical floodplain restoration, CM5 could result in periodic inundation of up to 148 acres of modeled yellow-breasted chat habitat. Inundation of restored floodplains is not expected to affect yellow-breasted chat or its habitat because the chat breeding period is outside the period the floodplains would likely be inundated. In addition, providing for periodic inundation of floodplains is expected to restore a more natural flood regime in support of riparian vegetation types that provide nesting and migratory habitat for yellow-breasted chat. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increases in the frequency and duration of Yolo Bypass flooding and CM5 floodplain restoration would be expected to create more natural flood regimes that would support riparian habitat, which would not result in an adverse effect on yellow breasted chat.

CEQA Conclusion: Periodic inundation would have a less-than-significant impact on yellow-breasted chat because inundation would occur outside of the breeding season and would not be expected to adversely modify habitat or result in direct mortality of the species. Flooding promotes the germination and establishment of many native riparian plants. Therefore, the overall impact of seasonal inundation would be beneficial for yellow-breasted chat.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled breeding habitat for these species is restricted to valley/foothill riparian forest.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-9-43. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP that would also benefit Cooper's hawk and osprey (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7)
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Plant and maintain native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SH2.1, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the acres of restoration or protection included in the Plan, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-43. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Nesting	43	43	89	89	NA	NA
Total Impacts CM1		**43**	**43**	**89**	**89**	**NA**	**NA**
CM2–CM18	Nesting	312	507	88	121	48–82	230
Total Impacts CM2–CM18		**312**	**507**	**88**	**121**	**48–82**	**230**
TOTAL IMPACTS		**355**	**550**	**177**	**210**	**48–82**	**230**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 760 acres of modeled nesting habitat for Cooper's hawk and osprey (Table 12-9-43). Conservation measures that would result in these losses are *CM1 Water Facilities and Operations* (which would involve conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 132 acres of modeled Cooper's hawk and osprey habitat (Table 12-9-43). Of the 132 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 43 acres would be a permanent loss and 89 acres would be a temporary loss of habitat. Activities that would impact nesting habitat include channel dredging, intakes, fish barriers, access roads, and construction of transmission lines. Of the 132 acres of nesting habitat that would be removed for the construction of the conveyance facilities, 43 acres would be a permanent loss and 89 acres would be a temporary loss of habitat. Permanent losses would primarily consist of channel enlargement at the Sacramento River and Meadows Slough. Temporary losses would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. The riparian habitat in these areas is composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on cooper's hawk and osprey if either species were to nest in or adjacent to the construction footprint. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 170 acres of Cooper's hawk and osprey nesting habitat (82 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential Cooper's hawk and osprey habitat. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration could permanently remove up to 383 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions would remove approximately 75 acres of Cooper's hawk and osprey nesting habitat (42 acres of permanent loss, 33 acres of temporary loss). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 9 would remove 532 acres (355 acres of permanent loss, 177 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 132 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 132 acres of nesting habitat should be restored/created and 132 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. In order for the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 760 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. In order for the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address this adverse effect.

NEPA Effects: The loss of Cooper's hawk and osprey habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM5, CM7, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss on Cooper's hawk and osprey under Alternative 9 would not be adverse. Cooper's hawk and osprey are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effect of construction would not be adverse under NEPA. Alternative 9 would remove 532 acres (355 acres of permanent loss, 177 acres of temporary loss) of Cooper's hawk and osprey nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 132 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—400 acres of habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat Using these ratios would indicate that 132 acres of nesting habitat should be restored/created and 132 acres should be protected to compensate for the CM1 losses of modeled Cooper's hawk and osprey habitat. In addition, the near-term effects of other conservation actions would remove 400 acres of modeled breeding habitat, and therefore require 400 acres of restoration and 400 acres of protection of modeled Cooper's hawk and osprey using the same typical NEPA and CEQA ratios.

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, and CM7 and would occur in the same timeframe as the construction and early restoration losses. The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on Cooper's hawk and osprey nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by these species. This time lag between the removal and restoration of nesting habitat could have a substantial impact on nesting raptors in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the BDCP reserve system in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (CM5, CM7). Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the conserved lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. In order for the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting Cooper's hawk and osprey to a less-than–significant level.

Late Long-Term Timeframe

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 760 acres of potential nesting habitat (5% of the potential nesting habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit Cooper's hawk and osprey by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Cooper's hawk and osprey are not species that are covered under the BDCP. In order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for the time lag of restoring riparian habitats lost to construction and restoration activities, and with implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Cooper's hawk and osprey. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Cooper's hawk and osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of Plan Implementation on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under CM1 were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury*

Management contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cooper's hawk and osprey.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Cooper's hawk and osprey.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Cooper's hawk and osprey from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on cooper's hawk and osprey. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Cooper's hawk and osprey, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 9 would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury through the ingestion of fish or small mammals in restored tidal areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12, would address the uncertainty of methylmercury levels in restored tidal marsh in the study area and better inform potential impacts on Cooper's hawk and osprey.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 48–82 acres of modeled Cooper's hawk and osprey breeding habitat However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 230 acres of breeding habitat for Cooper's hawk and osprey. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would not have an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration and inundation from CM2 and CM5 would have a less-than-significant impact on Cooper's hawk and osprey.

Golden Eagle and Ferruginous Hawk

Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-9-44. Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP that would benefit golden eagle and ferruginous hawk (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at last 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).

- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-44. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Foraging	318	318	1,281	1,281	NA	NA
Total Impacts CM1		**318**	**318**	**1,281**	**1,281**	**NA**	**NA**
CM2–CM18	Foraging	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**5,768**	**26,516**	**1,657**	**2,174**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 28,690 acres of modeled foraging habitat for golden eagle and ferruginous hawk (26,516 acres of permanent loss and 2,174 acres of temporary loss, Table 12-9-44). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 427 acres of modeled golden eagle and ferruginous hawk foraging habitat (83 acres of permanent loss, 344 acres of temporary loss) from CZ 4, 5, 6, 7, and 8. The permanent and temporary losses to habitat would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. The CM1 construction footprint does not overlap with any occurrences of golden eagle or ferruginous hawk. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled golden eagle and ferruginous hawk foraging habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.
- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled golden eagle and ferruginous hawk foraging habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide foraging habitat for golden eagle and ferruginous hawk and would result in the conversion of 837 acres of cultivated lands to grassland.
- *CM10 Nontidal Marsh Restoration:* Implementation of CM10 would result in the permanent removal of 705 acres of golden eagle and ferruginous hawk foraging habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat for these species. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.
- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of modeled golden eagle and ferruginous hawk foraging habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures

(*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat* would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of modeled golden eagle and ferruginous hawk foraging habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects**:** The loss of golden eagle and ferruginous hawk habitat and potential mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat*, the effects of habitat loss and potential direct mortality on golden eagle and ferruginous hawk under Alternative 9 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled golden eagle and ferruginous hawk foraging habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of golden eagle and ferruginous hawk foraging habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of golden eagle and ferruginous hawk habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on golden eagle and ferruginous hawk foraging in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand golden eagle and ferruginous hawk foraging habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential foraging habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for golden eagle and ferruginous hawk.

These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on golden eagle and ferruginous hawk, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. The implementation of Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat* would reduce the impact of habitat loss in the near-term to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of modeled golden eagle and ferruginous hawk foraging habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand foraging habitat for golden eagle and ferruginous hawk and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect and small mammal prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Burrow availability would be increased on protected natural communities by encouraging ground squirrel occupancy and expansion through the creation of berms, mounds, edges, and through the prohibition of ground squirrel control programs (i.e., poisoning). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for golden eagle and ferruginous hawk (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) which are also suitable for golden eagle and ferruginous hawk.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

In the absence of other conservation actions, the effects on golden eagle and ferruginous hawk foraging habitat would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species; however, considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-113, *Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat,* the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on golden eagle and ferruginous hawk.

Mitigation Measure BIO-113: Compensate for the Near-Term Loss of Golden Eagle and Ferruginous Hawk Foraging Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide golden eagle and ferruginous hawk foraging habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters. which would substantially reduce any potential for powerline collisions.

***NEPA Effects*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater*

Sandhill Crane, the construction and operation of transmission lines would not result in an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-115: Indirect Effects of Plan Implementation on Golden Eagle and Ferruginous Hawk

Indirect Construction- and Operation-Related Effects: Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 9 implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 9 implementation would not have an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 9 implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the BDCP, indirect effects as a result of Alternative 9 implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650acres of modeled golden eagle and ferruginous hawk foraging habitat (Table 12-9-44).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-9-44).

Golden eagles and ferruginous hawks would not likely use inundated areas for foraging, and increased inundation frequency and duration of inundation of grassland habitats may affect prey populations that have insufficient time to recover following inundation events. However, periodically inundated habitat would not be expected to have an adverse effect on local or migratory golden eagles or the wintering ferruginous hawk population in the area.

NEPA Effects: Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would not be expected to have an adverse effect on the wintering golden eagle or ferruginous hawk populations in the study area.

CEQA Conclusion: Implementation of CM2 would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled golden eagle and ferruginous hawk foraging habitat. In addition, implementation of CM5 could result in the periodic inundation of up to 3,823 acres of modeled habitat. However, periodic inundation would be expected to have a less-than-significant impact on the golden eagle and ferruginous hawk populations in the study area.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-9-45. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of lost habitat. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP that would also benefit cormorants, herons, and egrets (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM18 Swainson's Hawk*, and Mitigation Measures BIO-75 and BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-45. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting (Rookeries)	61	61	248	248	NA	NA
Total Impacts CM1		**61**	**61**	**248**	**248**	NA	NA
CM2–CM18	Nesting (Rookeries)	387	684	88	123	51–92	266
Total Impacts CM2–CM18		**387**	**684**	**88**	**123**	**51–92**	**266**
TOTAL IMPACTS		**448**	**745**	**336**	**371**	**51–92**	**266**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 1,116 acres of modeled habitat (745 acres of permanent loss, 371 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-9-45). Conservation measures that would result in these losses are *CM1 Water Facilities and Operation* (which would involve conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 309 acres of modeled Cormorant, heron, and egret habitat (Table 12-9-45). Of the 309 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 61 acres would be a permanent loss and 248 acres would be a temporary loss of habitat. Permanent losses would primarily consist of channel enlargement at the Sacramento River and Meadows Slough. Temporary losses would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. The riparian habitat in these areas is composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

  The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. The CM1 footprint overlaps with one great blue heron rookery on an instream island northeast of Woodward Island. This rookery occurrence was recorded in 2000 by the CNDDB and was recorded again during DHCCP surveys in 2009. The CM1 footprint includes dredging of Middle River and inchannel island dredging that would remove the island on which the rookery is located. In addition, the rookery could be indirectly affected by the barge facility work area and dredging work area to the west on Woodward Island. Because the species is highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. Therefore to avoid adverse effects on great blue herons (and cormorants, herons, and egrets, should future surveys detect additional rookeries), this rookery would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address this adverse effect on great blue herons. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 177 acres of nesting habitat (89 acres of permanent loss, 88 acres of temporary loss) in the Yolo Bypass in CZ 2. Activities through CM2 could involve excavation and grading in valley/foothill riparian areas to improve passage of fish through the bypasses. Most of the riparian losses would occur at the north end of Yolo Bypass where major fish passage improvements are planned. Excavation to improve water movement in the Toe Drain and in the Sacramento Weir would also remove potential nesting habitat. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated552 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species. There is one CNDDB occurrence of a great blue heron rookery that overlaps with the hypothetical restoration footprint for tidal restoration. The occurrence is on Decker Island and tidal restoration could potentially impact the nest trees from inundation. This potential effect would need to be addressed within the project-specific analysis for tidal restoration projects.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently remove approximately 43 acres and temporarily remove approximately 35 acres of potential cormorants, heron, and egret nesting habitat. These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Permanent and temporary habitat losses from the above conservation measures would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.

- The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. To avoid adverse effects on these species, existing known nest sites would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address these potential effects on cormorants, herons, and egrets.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measures BIO-75 and BIO-117 would be available to address these effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 784 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 309 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 309 acres of breeding habitat should be restored/created and 309 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid adverse effects on individuals, existing nests and rookeries would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address adverse effects on nesting cormorants, herons, and egrets.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,116 acres of potential breeding habitat (6% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites, and, in order for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting cormorants, herons, and egrets.

NEPA Effects: The loss of cormorant, heron, and egret habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM5, CM7, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7 and *AMM18 Swainson's Hawk*, which would be in place throughout the construction period, the effects of habitat loss and potential mortality on cormorants, herons, and egrets under Alternative 9 would not be adverse. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. Preconstruction surveys for noncovered species would be required for the BDCP to avoid an adverse effect on individuals. Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address effects on nesting cormorants, herons, and egrets.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under NEPA. Alternative 9 would remove 784 acres of nesting habitat for cormorants, herons, and egrets in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 309 acres of nesting habitat), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancemen*t, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—475 acres of nesting habitat).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for breeding habitat. Using these ratios would indicate that 309 acres of breeding habitat should be restored/created and 309 acres should be protected to compensate for the CM1 losses of modeled cormorant, heron, and egret habitat. In addition, the near-term effects of other conservation actions would remove 475 acres of modeled breeding habitat, and therefore require 475 acres of restoration and 475 acres of protection of modeled cormorant, heron, and egret habitat using the same typical NEPA and CEQA ratios.

The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community

(Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for these species. In addition, small but essential nesting habitat associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Objective CLNC1.3).

The 750 acres of protection and 800 acres of restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and other near-term impacts on cormorant, heron, and egret nesting habitat. The 800 acres of restored riparian habitat would be initiated in the near-term to offset the loss of potential nesting habitat, but would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for established rookeries. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons and egrets in the near-term time period.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the BDCP reserve system for every tree 20 feet or taller removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout protected lands. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. For the BDCP to avoid a significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 1,116 acres of potential breeding habitat (5% of the potential breeding habitat in the study area).

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM5 Seasonally Inundated Floodplain Restoration,* and *CM7 Riparian Natural Community Restoration* to restore or create at least 5,000 acres and protect at least 750 acres of valley/foothill riparian natural community (Table 3-4 in Chapter 3, *Description of Alternatives*). The majority of riparian protection and restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*). Riparian restoration would expand the patches of existing riparian forest in order to support nesting habitat for riparian species. The Plan's objectives would also benefit cormorants, herons, and egrets by protecting small but essential habitats that occur within cultivated lands, such as tree rows along field borders or roads, and small clusters of trees in farmyards or rural residences (Objective CLNC1.3). In addition, the distribution and abundance of potential nest trees would be increased by planting and maintaining native trees along roadsides and field borders within protected cultivated lands at a rate of one tree per 10 acres (Objective SWHA2.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron are not species that are covered under the BDCP. These species are highly traditional in their use of nest sites and, for the BDCP to avoid a significant impact on individuals, preconstruction surveys would be required to ensure that nests are detected and any direct and indirect impacts on rookeries are avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would reduce this potential impact to a less-than-significant level.

In the absence of other conservation actions, effects on nesting cormorants, herons, and egrets would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts sufficient to compensate for the loss of riparian habitats lost to construction and restoration activities, and considering implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-117, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of cormorants, herons, and egrets. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries): therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of Plan Implementation on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets.

A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. This review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification.

Largemouth bass was used as a surrogate species for analysis (Appendix 11F, *Substantive BDCP Revisions*) and the modeled effects of mercury concentrations from changes in water operations under CM1 on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that cormorant, heron, and egret tissue concentrations would not measurably increase as a result of CM1 implementation.

Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly effect on cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-BDCP, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury*

Management contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on cormorants, herons or egrets.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets.

***CEQA Conclusion*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would

represent an adverse effect in the absence of other conservation actions. This impact would be significant. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium which could result in mortality of special-status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1-7, AMM27, and CM12 in place, in addition to the implementation of Mitigation Measure BIO-75 and BIO-117 measures in place, indirect effects of plan implementation would not result in a substantial adverse effect on cormorants, herons, and egrets through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (CM2) would increase the frequency and duration of inundation of approximately 51–92 acres of modeled breeding habitat for cormorants, herons and egrets. However, increased periodic flooding is not expected to cause any adverse effect on breeding habitat because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters.

Based on hypothetical floodplain restoration, CM5 implementation could result in periodic inundation of up to 266 acres of breeding habitat for cormorants, herons and egrets. The overall effect of seasonal inundation in existing riparian natural communities is likely to be beneficial for these species, because, historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants.

NEPA Effects: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation from CM2 and CM5 would not result in an adverse effect on cormorants, herons and egrets.

CEQA Conclusion: Increased periodic flooding would not be expected to cause any adverse effect on nest sites because trees in which nest sites are situated already withstand floods, the increase in inundation frequency and duration is expected to remain within the range of tolerance of riparian trees, and nest sites are located above floodwaters. Therefore, increased duration of periodic inundation from CM2 and CM5 would have a less-than-significant impact on cormorants, herons and egrets.

Short-Eared Owl and Northern Harrier

Modeled habitat for short-eared owl and northern harrier consists of tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, other natural seasonal wetland, grassland, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-9-46. Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP that would benefit short-eared owl and northern harrier (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 6,000 acres of tidal brackish emergent wetland in CZ 11 including at least 1,500 acres of middle and high marsh (Objectives TBEWNC1.1 and TBEWNC1.2, associated with CM4).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.2, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7, *AMM27 Selenium Management* and Mitigation Measure BIO-75, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-46. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting and Foraging	419	419	1,468	1,468	NA	NA
Total Impacts CM1		**419**	**419**	**1,468**	**1,468**	**NA**	**NA**
CM2–CM18	Nesting and Foraging	12,281	46,700	471	1,224	2,926–8,060	5,978
Total Impacts CM2–CM18		**12,281**	**46,700**	**471**	**1,224**	**2,926–8,060**	**5,978**
TOTAL IMPACTS		**12,700**	**47,119**	**1,939**	**2,692**	**2,926–8,060**	**5,978**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 34,689 acres of modeled habitat for short-eared owl and northern harrier (of which 32,369 acres would be a permanent loss and 2,320 acres would be a temporary loss of habitat, Table 12-9-46). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), grassland restoration (CM8), vernal pool and wetland restoration (CM9), marsh restoration (CM10) and construction of conservation hatcheries (CM18). The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 1,887 acres of modeled short-eared owl and northern harrier habitat (419 acres of permanent loss, 1,468 acres of temporary loss) from CZs 4, 5, 6, 7, and 8. The majority of habitat removed would be grassland and cultivated lands. However, fringes of tidal freshwater emergent wetland along channels and island edges would also be impacted from construction activities. There are no occurrences of nesting short-eared owl and northern harrier that overlap with the construction footprint of CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on short-eared owls and northern harriers if they were to nest in or adjacent to construction activities. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would permanently remove 1,021 acres of modeled short-eared owl and northern harrier habitat in the Yolo Bypass in CZ 2. In addition, 471 acres of habitat would be temporarily removed. The impact would primarily consist of loss of acreages of pastures. The conversion is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 39,017 acres of modeled short-eared owl and northern harrier habitat. The majority of the losses would be managed wetlands and cultivated lands in CZs 1, 2, 4, 5, 6, 7, 8, 10, and 11. Tidal restoration actions through CM4 would restore an estimated 55,000 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the extent and value of their nesting habitat. Grizzley Island supports the only known resident population of short-eared owls in the Suisun Marsh and Sacramento-San Joaquin River Delta (Roberson 2008). Grizzley Island does not overlap with the hypothetical footprint for CM4. However, this is an important breeding area for short-eared owl and if restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding short-eared owls could likely be adverse. Future NEPA and CEQA analysis would be conducted for restoration projects under BDCP and if restoration was proposed to occur outside of the hypothetical footprints used for this programmatic analysis, potential impacts on these species would be captured in the project-level analysis (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 2,086 acres of modeled short-eared owl and northern harrier habitat (1,332 permanent, 754 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 623 acres of short-eared owl and northern harrier habitat as part of tidal restoration and 2,479 acres of habitat as part of seasonal floodplain restoration.
- *CM8 Grassland Natural Community Restoration*: Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 1,066 acres of cultivated lands to grassland in CZs 1, 2, 4, 5, 7, 8, and 11. The resulting 2,000 acres of grassland would provide habitat for short-eared owl and northern harrier.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected

habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to minimize these effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of short-eared owl and northern harrier habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 14,639 acres of modeled habitat (12,700 permanent, 1,939 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,887 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these typical ratios would indicate that 1,887 acres of habitat should be restored and 1,887 acres should be protected to compensate for the CM1 losses of short-eared owl and northern harrier habitat. The near-term effects of other conservation actions would remove 12,752 acres of modeled habitat, and therefore require 12,752 acres of restoration and 12,752 acres of protection of short-eared owl and northern harrier habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses. The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1 and the effects from other near-term restoration actions.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which currently supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 49,811 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, and *CM8 Grassland Natural Community Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. In order for the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects: The loss of short-eared owl and northern harrier habitat and potential direct mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of short-eared owl and northern harrier habitat loss resulting from Alternative 9 would not be adverse. Short-eared owl and northern harrier are not covered species under the BDCP, and preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address the adverse effect of direct mortality on short-eared owl and northern harrier.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 14,639 acres of modeled habitat (12,700 permanent, 1,939 temporary) for short-eared owl and northern harrier in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,887 acres), and implementing other conservation measures (*CM2 Yolo*

Bypass Fisheries Enhancement, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—12,752 acres).

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The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, protecting 4,800 acres of managed wetland natural community, protecting 15,400 acres of non-rice cultivated lands, protecting 900 acres of rice or rice equivalent habitat, and restoring 19,150 acres of tidal wetlands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM4, and CM8 and would occur in the same timeframe as the construction and early restoration losses. The acres of protection and restoration contained in the near-term Plan goals satisfy the typical mitigation ratios that would be applied to the project-level effects of CM and the effects from other near-term restoration actions.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island.

The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1). A minimum of 87% of cultivated lands protected by the late long-term time period would be in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2). This biological objective provides an estimate for the proportion of cultivated lands protected in the near-term time period which would provide suitable nesting and foraging habitat for short-eared owl and northern harrier. These biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions.

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The short-eared owl and the northern harrier are not covered species under the BDCP. For the BDCP to avoid adverse effects on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 49,811 acres of modeled short-eared owl and northern harrier habitat during the term of the Plan (12% of the modeled habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, and CM8 Grassland Natural Community Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, protect 8,100 acres of managed wetland, protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species, and restore at least 65,000 acres of tidal wetlands (Table 3-4 in Chapter 3).

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide nesting and foraging habitat for short-eared owl and northern harrier and reduce the effects of current levels of habitat fragmentation. Small mammal populations would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Remnant patches of grassland or other uncultivated areas would also be protected and maintained as part of the cultivated lands reserve system which would provide additional foraging habitat and a source of rodent prey that could recolonize cultivated fields (Objective CLNC1.3). The protection of managed wetlands (including upland grassland components) would preserve habitat for short-eared owl and northern harrier (Objective MWNC1.1). Protection and enhancement of managed wetlands to meet this objective would focus on highly degraded areas in order to provide the greatest possible level of enhancement benefit to the managed wetland natural community and associated species. Managed wetland protection and enhancement would be concentrated in Suisun Marsh, which supports a high concentration of nesting short-eared owls on Grizzley Island. At least 1,500 acres of the managed wetlands would be protected and enhanced on Grizzley Island by the late long-term time period. The restoration of 19,150 acres of tidal natural communities, including transitional uplands would provide nesting and foraging habitat for short-eared owl and northern harrier. Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields. A minimum of 87% of the 48,625 acres of cultivated lands protected by the late long-term time period (Objective CLNC1.1) would be managed in alfalfa, irrigated pasture, and other hay crops (Objective SH1.2) which are compatible crop types for these species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Short-eared owl and northern harrier are not species that are covered under the BDCP. In order for the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that active nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be reduce the impact to a less-than-significant level.

In the absence of other conservation actions, effects on short-eared owl and northern harrier would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be considered significant. Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of short-eared owl and northern harrier. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

NEPA Effects**:** The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 9 would not result in an adverse effect on short-eared owl or northern harrier.

CEQA Conclusion**:** The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 9 would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of Plan Implementation on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to short-eared owl and northern harrier could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on short-eared owl and northern harrier.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce short-eared owl and northern harrier use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Tidal habitat restoration is unlikely to have an adverse effect on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in CM12 *Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for short-eared owl and northern harrier, once site specific sampling and other information could be developed.

CEQA Conclusion: Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have a less-than-significant impact on short-eared owl and northern harrier with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. Tidal habitat restoration is unlikely to have a significant impact on short-eared owl and northern harrier through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to these species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 9 implementation would result in a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 2,926–8,060 acres of modeled short-eared owl and northern harrier habitat (Table 12-9-46).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 5,978 acres of modeled habitat (Table 12-9-46), the majority of which would be pasture and other cultivated lands.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on short-eared owl and northern harrier because inundation is expected to occur prior to the breeding season.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in the *General Terrestrial Biology Effects* section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on mountain plover. Modeled habitat for mountain plover consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-9-47. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit the mountain plover (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-47. Changes in Mountain Plover Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Wintering	318	318	1,281	1,281	NA	NA
Total Impacts CM1		**318**	**318**	**1,281**	**1,281**	**NA**	**NA**
CM2–CM18	Wintering	5,450	26,198	376	893	1,158–3,650	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**1,158–3,650**	**3,823**
TOTAL IMPACTS		**5,768**	**26,516**	**1,657**	**2,174**	**1,158–3,650**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 28,690 acres of modeled habitat for mountain plover (25,516 acres of permanent loss and 2,174 of temporary loss, Table 12-9-47). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 1,559 acres of modeled mountain plover habitat (318 acres of permanent loss, 1,281 acres of temporary loss) from CZ 4, 5, 6, and 8. These losses would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. Other impacts would occur from potential borrow and spoil sites, access roads, barge unloading facilities, and intake and fish screen construction areas. There are no CNDDB occurrences of mountain plover that intersect with the CM1 footprint. However, the study area does overlap with the species' winter range, and there are occurrences west and north of the study area. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled mountain plover wintering habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled mountain plover habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of mountain plover wintering habitat as part of tidal restoration and 1,489 acres of habitat as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide wintering habitat for mountain plover and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration*: Implementation of CM10 would result in the permanent removal of 705 acres of mountain plover habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available mountain plover habitat. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled mountain plover habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7and conservation actions as described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on mountain plover wintering in the study area. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand mountain plover wintering habitat and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which are also modeled habitat for wintering mountain plover. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would be suitable for mountain plover.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 269,411 acres of potential habitat for mountain plover. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of modeled mountain plover wintering habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives

ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential wintering habitat for mountain plover. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

NEPA Effects: The loss of mountain plover habitat and potential mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, and with implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat,* the effects of habitat loss and potential for direct mortality on mountain plover under Alternative 9 would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled mountain plover wintering habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of mountain plover wintering habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of mountain plover habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts of habitat loss on mountain plover. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential wintering habitat for mountain plover (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential habitat for mountain plover wintering in the study area. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide habitat for mountain plover.

These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on mountain plover, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. The implementation of Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, would reduce the impact of habitat loss in the near-term to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of mountain plover habitat during the term of the Plan (11% of the total habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand wintering habitat for mountain plover and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential habitat for mountain plover (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide habitat for mountain plover.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-125, *Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on mountain plover.

Mitigation Measure BIO-125: Compensate for the Near-Term Loss of Mountain Plover Wintering Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide habitat for mountain plover such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

NEPA Effects: New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely because of plovers' flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on mountain plover.

CEQA Conclusion: New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely because of plovers' flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of Operations and Maintenance of Water Conveyance Facilities on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on mountain plover as a result of Alternative 9 implementation could have adverse effects on the species through the modification of habitat. With the With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 9 implementation would not have an adverse effect mountain plover.

CEQA Conclusion: Indirect effects on mountain plover as a result of Alternative 9 implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 9 implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled mountain plover wintering habitat (Table 12-9-47). Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration*, could result in the periodic inundation of up to approximately 3,823 acres of modeled mountain plover habitat (Table 12-9-47).

NEPA Effects: Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would not have an adverse effect on mountain plover because birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would periodically inundate suitable mountain plover foraging habitat. However, effects of periodic inundation would have a less-than-significant impact on mountain plover because birds would be expected to move to adjacent foraging habitat.

Black Tern

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled habitat for black tern as indicated in Table 12-9-48. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit the black tern (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect 700 acres of cultivated lands, with at least 500 acres consisting of rice land, to expand upon and buffer newly restored/created nontidal perennial habitat in CZ 2, (Objective GGS2.3, associated with CM3).
- Protect up to 1,700 acres of rice land or equivalent habitat (e.g., perennial wetland) in the Yolo Bypass if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species*, for giant garter snake. Any remaining acreage (from a total 2,740-acre commitment) will consist of rice land or equivalent-value habitat outside the Yolo Bypass in CZs 1, 2, 4, or 5 (Objective GGS3.1, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).

As explained below, with the restoration and protection of these amounts of habitat, in addition to management activities that would enhance this habitat for the species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on black tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-48. Changes in Black Tern Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	NA	NA
CM2–CM18	Nesting	306	490	1	1	791–1,582	0
Total Impacts CM2–CM18		**306**	**490**	**1**	**1**	**791–1,582**	**0**
TOTAL IMPACTS		**306**	**490**	**1**	**1**	**791–1,582**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

Alternative 9 conservation measures would result in the permanent loss of up to 491 acres of modeled nesting habitat for black tern, consisting of freshwater wetlands and rice in CZ 2 (Table 12-9-48). Conservation measures that would result in these losses are Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), grassland restoration (CM8) and nontidal marsh restoration (CM10). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 31 acres of modeled black tern habitat in the Yolo Bypass in CZ 2. In addition, 1 acre of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 199 acres of modeled black tern habitat in CZ 2.
- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 52 acres of rice lands to grassland in CZ 2 by the late-long time period. An estimated 30 acres of impact would occur in the first 10 years.
- *CM10 Nontidal Marsh Restoration:* Implementation of *CM10* would result in the permanent removal of 208 acres of black tern nesting habitat in in CZ 2. An estimated 46 acres would be removed in the first 10 years.

CM11 Natural Communities Enhancement and Management: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Habitat management- and enhancement-related activities could disturb nesting black terns if they were to nest in the vicinity of a worksite. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of black tern would be minimized with the implementation of and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- Operations and Maintenance: Postconstruction operation and maintenance of the restoration infrastructure could result in ongoing but periodic disturbances that could affect black tern nesting adjacent to maintenance areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged black tern individuals if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If black tern were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of Mitigation Measure BIO-75.
- Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. This potential impact is further described under Impact BIO-129c below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements,*

CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to compensate for the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to avoid an adverse effect on black tern from habitat loss, protection and restoration of 307 acres of rice and/or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would be available to address this adverse effect.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments

through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects**:** The loss of black tern nesting habitat and potential for mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection associated with CM3, guided by biological goals and objectives and AMM1–AMM6, which would be in place throughout the construction period, the effects of habitat loss under Alternative 9 would not be adverse under NEPA. Black tern is not a covered species under the BDCP and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

CEQA Conclusion**:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. There would be no impacts on black tern nesting habitat resulting from the construction of the water conveyance facilities (CM1). However, there would be a loss of 307 acres of modeled nesting habitat for black tern in the study area in the near-term. These effects would result from implementing *CM2 Yolo Bypass Fisheries Enhancements, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration* and *CM10 Nontidal Marsh Restoration.*

The typical NEPA and CEQA project-level mitigation ratio would be 1:1 protection and 1:1 restoration for the loss of black tern nesting habitat. Using this ratio would indicate that 307 acres of rice lands and/or freshwater wetlands should be protected and 307 acres should be restored in CZ 2 to mitigate the losses of black tern nesting habitat.

The BDCP has committed to near-term goals of protecting 200 acres of rice and 700 acres of rice or equivalent habitat habitat and restoring 8,850 acres of tidal freshwater emergent wetland (see Table 3-4 in Chapter 3 *Description of Alternatives*). These conservation actions are associated with CM3 and CM4 and would occur in the same timeframe as the early restoration losses. The BDCP also contains objectives for the giant garter snake to protect at least 500 acres of rice in CZ 2 and to protect up to 1,700 acres of rice land or equivalent habitat in the Yolo Bypass (if this portion meets the criteria specified in CM3, *Reserve Design Requirements by Species* for giant garter snake, Objectives GGS2.3 and GGS 3.1) by the late long-term time period. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2).

These objectives would inform the near-term protection actions, and therefore some portion of the 200 acres of rice and 700 acres of rice or equivalent habitat and the 8,850 acres of tidal freshwater emergent wetland would be expected to be restored and protected in CZ 2. However, there is no near-term acreage commitment in the plan that is specific to CZ 2. In order to compensate for black tern habitat loss, the protection and restoration of 307 acres of rice or freshwater wetlands would need to occur in CZ 2 in the near-term timeframe. Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, would reduce this potential impact to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction would be required to ensure that nests are detected and avoided. In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. This impact would be significant. However, the BDCP has committed to habitat protection, restoration, management and enhancement activities described above. As outlined in BDCP Chapter 3, Section 3.4, *Conservation Measures*, natural community restoration and protection are planned so that they keep pace with project impacts. Thus, there would be minimal lag time between impacts and those measures designed to offset those impacts on natural communities and the species that use them. In addition, implementation of AMM1-AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-129a, *Compensate for Loss of Black Tern Nesting Habitat*, which would require 1:1 protection of habitat in CZ 2 in the near-term time frame, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of 491 acres of modeled black tern nesting habitat during the term of the Plan. This impact would result from the removal or conversion of rice and freshwater wetlands in CZ 2. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration* to protect 500 acres of rice lands (see Table 3-4 in Chapter 3, *Description of Alternatives*) and up to 1,700 acres of rice lands or equivalent habitat for the giant garter snake (Objective GGS3.1) in CZ 2. The nesting habitat for black tern in the northern part of the study area has largely been reduced to rice lands, and these acres would provide protected nesting habitat for the species. The Plan also includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1).

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, and *AMM6 Disposal and Reuse of Spoils.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Black tern is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting terns during preconstruction surveys and ensure that active nests are avoided, which would reduce the potential impact on nesting black tern to a less-than-significant level.

In the absence of other conservation actions, effects on black tern would represent an adverse effect as a result of habitat modification and potential for direct mortality of special-status species. This impact would be significant. Considering these protection provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on black tern.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-129a: Compensate for loss of black tern nesting habitat

Because there is no near-term acreage commitment associated with the protection of rice in CZ 2, BDCP proponents must protect rice at a 1:1 ratio for each acre of rice impacted in CZ 2.

Impact BIO-129b: Indirect Effects of Plan Implementation on Black Tern

If black terns were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting black terns. The use of mechanical equipment during restoration activities could cause the accidental release of petroleum or other contaminants that could affect black terns in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including black tern. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy,* for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on black tern.

Because of the uncertainty that exists at this programmatic level of review, there could be an effect on black tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of black tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of conservation components could affect black tern use of modeled habitat adjacent to work areas. Moreover, the use of mechanical equipment for the construction of conservation components could cause the accidental release of petroleum or other contaminants, or the inadvertent discharge of sediment or excess dust adjacent to suitable habitat which could result in potential mortality of a special-status species. These impacts would be significant. AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce these impacts to a less-than–significant level. Tidal habitat restoration could result in increased exposure of black tern to selenium, which could result in the mortality of a special-status species. This impact would be significant. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With AMM27 in place, potential effects of increased exposure of black tern to selenium would be reduced to a less-than-significant impact.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass would inundate 791–1,582 acres of suitable black tern nesting habitat (land currently managed as rice in CZ 2). Inundation would occur during the nonbreeding season but could reduce the availability of nesting habitat during years that flooding extends into the nesting season (past March). Extended inundation of the Yolo Bypass would not be expected to affect black tern nesting habitat. However, if periodic inundation took land out of rice production, this could have an adverse effect on black tern nesting habitat. Late season flooding in the Yolo Bypass could result in the loss of rice (nesting habitat for black tern) by precluding the preparation and planting of rice fields. The methods for estimating loss of rice in the bypass and results are provided in BDCP Appendix 5.J, Attachment 5J.E, *Estimation of BDCP Impact on Giant Garter Snake Summer Foraging Habitat in the Yolo Bypass.* This analysis concludes that the estimated loss of rice could be up to 1,662 acres by the late long-term timeframe. The BDCP has committed to protect, restore and/or create up to 1,700 acres of rice in the Yolo Bypass (Objective GGS3.1). These acres of rice would be protected in areas that are less susceptible to inundation, which would benefit the black tern during years in which the magnitude and duration of inundation were increased.

***NEPA Effects*:** Flooding of the Yolo Bypass is not expected to adversely affect nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential effect would not be adverse with the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1 in the BDCP.

CEQA Conclusion: Flooding of the Yolo Bypass is not expected to have a significant impact on nesting habitat for black tern. However, if flooding were to extend into the nesting season or were to significantly reduce rice production it could also reduce suitable black tern nesting habitat. This potential impact would be reduced to less than significant by the creation and/or protection of 1,700 acres of rice in CZ 2 under Objective GGS3.1 in the BDCP.

California Horned Lark and Grasshopper Sparrow

The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of breeding habitat in the study area, which consists of grassland, vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture. Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-9-49. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit the California horned lark and the grasshopper sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Within the 48,625 acres of protected cultivated lands, protect at least 42,275 acres of cultivated lands as Swainson's hawk foraging habitat with at least 50% in very high-value habitat in CZs 2, 3, 4, 5, 7, 8, 9, and 11 (Objective SH1.2, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species, and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-49. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	318	318	1,281	1,281	NA	NA
Total Impacts CM1		**318**	**318**	**1,281**	**1,281**	NA	NA
CM2–CM18	Breeding	5,450	26,198	376	893	777–2,423	3,823
Total Impacts CM2–CM18		**5,450**	**26,198**	**376**	**893**	**777–2,423**	**3,823**
TOTAL IMPACTS		**5,768**	**26,516**	**1,657**	**2,174**	**777–2,423**	**3,823**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 28,690 acres of modeled breeding habitat for California horned lark and grasshopper sparrow (26,516 acres of permanent loss, 2,174 acres of temporary loss, Table 12-9-49). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), and construction of conservation hatcheries (CM18). The majority of habitat loss (20,880 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 1,599 acres of potential California horned lark and grasshopper sparrow habitat (318 acres of permanent loss, 1,281 acres of temporary loss) from CZ 4, 5, 6, 7, and 8. These losses would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. Other impacts would occur from potential borrow and spoil sites, access roads, barge unloading facilities, and intake and fish screen construction areas. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and in the Stone Lakes NWR (6 occurrences). However, the CM1 footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on California horned larks and grasshopper sparrows if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of modeled California horned lark and grasshopper sparrow habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. Impacted habitat would consist primarily of grassland and pasture. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels. Realignment of Putah Creek could also involve excavation and grading in alkali seasonal wetland complex habitat as a new channel is constructed. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of modeled California horned lark and grasshopper sparrow nesting habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 370 acres of California horned lark and grasshopper sparrow nesting habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide nesting habitat for California horned lark and grasshopper sparrow and would result in the conversion of 837 acres of cultivated lands to grassland.

- *CM10 Nontidal Marsh Restoration*: Implementation of CM10 would result in the permanent removal of 705 acres of California horned lark and grasshopper sparrow nesting habitat.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects.
- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of modeled California horned lark and grasshopper sparrow habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would

provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding adverse effects of habitat loss on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would be available to address the adverse effect of habitat loss in the near-term.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types. These are very high- and high-value crop types for Swainson's hawk (Objective SH1.2) and would provide potential nesting habitat for California horned lark and grasshopper sparrow.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of California horned lark and grasshopper sparrow habitat and potential mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and AMM1–AMM7, which would be in place throughout the construction period, and with Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the effects of habitat loss under Alternative 9 on California horned lark and grasshopper sparrow would not be adverse under NEPA. California horned lark and grasshopper sparrow are not covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of modeled breeding habitat for California horned lark and grasshopper sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the CM1 losses of 1,599 acres of California horned lark and grasshopper sparrow habitat. The near-term effects of other conservation actions would remove 5,826 acres of modeled habitat, and therefore require 11,652 acres of protection of California horned lark and grasshopper sparrow nesting habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses thereby avoiding significant impacts on California horned lark and grasshopper sparrow. Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for

California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 87% of cultivated lands protected by the late long-term time period would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. This biological objective provides an estimate for the high proportion of cultivated lands protected in the near-term time period which would provide nesting habitat for California horned lark and grasshopper sparrow.

The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on California horned lark and grasshopper sparrow, as well as mitigate the near-term effects of the other conservation measures with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would be managed in suitable crop types to compensate for the loss of habitat at a ratio of 2:1. Implementation of Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, would reduce the impact of habitat loss in the near-term to a less-than-significant level.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 28,690 acres of modeled California horned lark and grasshopper sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand breeding habitat for California horned lark and grasshopper sparrow and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential nesting habitat for California horned lark and grasshopper sparrow (Objective CLNC1.1). Approximately 42,275 acres of cultivated lands protected would be in alfalfa and pasture crop types (very high- and high-value crop types) for Swainson's hawk (Objective SH1.2) which would also provide potential nesting habitat for California horned lark and grasshopper sparrow. The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. California horned lark and grasshopper sparrow are not covered species under the BDCP. For the BDCP to avoid significant impacts on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, and Mitigation Measure BIO-130, *Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of California horned lark and grasshopper sparrow. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on California horned lark and grasshopper sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-130: Compensate for the Near-Term Loss of California Horned Lark and Grasshopper Sparrow Habitat

DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa to provide California horned lark and grasshopper sparrow habitat such that the total acres of habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1 protection. Additional grassland protection, enhancement, and management may be substituted for the protection of cultivated lands.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of grasshopper sparrow and California horned lark. The potential for this risk, is considered minimal based on the flight behaviors of each species. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure. However, this would be expected to have few adverse effects on the grasshopper sparrow and California horned lark local populations.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane*, the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane*, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of Plan Implementation on Grasshopper Sparrow and California Horned Lark

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to grasshopper sparrow and California horned lark habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 9 implementation could have adverse effects on these species through the modification of habitat and potential direct mortality. California horned lark and grasshopper sparrow are not covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–

AMM7, Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on grasshopper sparrow and California horned lark as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on Grasshopper Sparrow and California Horned Lark as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 1,158–3,650 acres of modeled California horned lark and grasshopper sparrow habitat (Table 12-9-49).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 3,823 acres of modeled habitat (Table 12-9-49).

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, inundation would occur during the nonbreeding season and would not be expected to have an adverse effect on either species.

NEPA Effects: Periodic inundation of floodplains would not have adverse effects on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

CEQA Conclusion: Periodic inundation of floodplains would not have a significant impact on grasshopper sparrow or California horned lark because inundation is expected to occur prior to the breeding season.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 9, including water conveyance facilities construction and implementation of other conservation components, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis consists of tidal freshwater and nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZs 2, 4, and 11. Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled habitat for least bittern and white-faced ibis as indicated in Table 12-9-50. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit least bittern and white-faced ibis (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).

- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species, and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-50. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	1	1	0	0	NA	NA
Total Impacts CM1		**1**	**1**	**0**	**0**	NA	NA
CM2–CM18	Nesting	5,134	13,063	45	45	961–2,672	NA
Total Impacts CM2–CM18		**5,134**	**13,063**	**45**	**45**	**961–2,672**	**NA**
TOTAL IMPACTS		**5,135**	**13,064**	**45**	**45**	**961–2,672**	**NA**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 9 conservation measures would result in the combined permanent and temporary loss and conversion of up to 13,109 acres of modeled habitat for least bittern and white-faced ibis (13,064 acres of permanent loss and conversion and 45 of temporary loss, Table 12-9-50). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (CM11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below. A summary statement of the combined impacts, NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the permanent loss of 1 acre of modeled least bittern and white-faced ibis habitat from CZ 4. This loss would occur from the fringes of tidal freshwater emergent wetland along channels and island edges that would be impacted from channel dredging activities. The construction footprint for CM1 does not overlap with any occurrences of least bittern or white-faced ibis. The Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.
- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 55 acres of modeled least bittern and white-faced ibis habitat in the Yolo Bypass in CZ 2. In addition, 45 acres of habitat would be temporarily removed. The loss is expected to occur during the first 10 years of Alternative 9 implementation.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 13,008 acres of modeled least bittern and white-faced ibis habitat in CZ 2, 4, and 11 by the late long-term time period.
- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7described below and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce potential effects.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 5,180 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,135 acres of permanent loss, and 45 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 1 acre), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 1 acre of habitat should be restored and 1 acre of habitat should be protected to compensate for the CM1 losses of 1 acre of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland and protecting and enhancing 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Biological Goals and Objectives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 13,109 acres (13,064 acres of permanent loss, 45 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided.

NEPA Effects: The loss of least bittern and white-faced ibis habitat and potential mortality of these special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. However, with the habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss on least bittern and white-faced ibis would not be adverse under Alternative 9. Least bittern and white-faced ibis are not covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant under CEQA. Alternative 9 would remove 1,580 acres of modeled habitat for least bittern and white-faced ibis in the study area in the near-term (5,135 acres of permanent loss, and 45 acres of temporary loss). These effects would result from the construction of the water conveyance facilities (CM1, 1 acre), and the implementation of other conservation measures (Yolo Bypass fisheries enhancement [CM2], and tidal restoration [CM4] 5,179 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 1 acre of habitat should be restored and 1 acre of habitat should be protected to compensate for the CM1 losses of 1 acre of least bittern and white-faced ibis habitat. The near-term effects of other conservation actions would remove 5,179 acres of modeled habitat, and therefore require 5,179 acres of restoration and 5,179 acres of protection of least bittern and white-faced ibis habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection).

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal freshwater emergent wetland and 4,800 acres of managed wetland in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM4 and CM3 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on least bittern and white-faced ibis. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit these species through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 400 acres of nontidal marsh would be created, some of which would provide nesting habitat for least bittern and white-faced ibis. These Plan objectives represent performance standards for considering the effectiveness of restoration and protection actions. The acres of restoration and protection contained in the near-term Plan goals satisfy the typical mitigation that would be applied to the project-level effects of CM1, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the potential impact on nesting least bittern and white-faced ibis to a less-than-significant level.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 13,109 acres (13,064 acres of permanent loss, 45 acres of temporary loss) of least bittern and white-faced ibis habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM4 Tidal Natural Communities Restoration* to restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1). In addition, 1,200 acres of nontidal marsh would be created through *CM10 Nontidal Marsh Restoration* and 8,100 acres of managed wetland would be protected and enhanced in CZ 11.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Least bittern and white-faced ibis are not covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75 would reduce the potential impact on nesting least bittern and white-faced ibis and to a less-than-significant level.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of least bittern and white-faced ibis. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters, which would reduce bird strike risk of least bittern and white-faced ibis.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater*

Sandhill Crane would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of Plan Implementation on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to least bittern and white-faced ibis could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of other conservation actions. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: Indirect effects

of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of plan implementation would represent a substantial adverse effect in the absence of other conservation actions. This impact would be significant. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium*

Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of plan implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other conservation measures. This would be a significant impact. With AMM1-7, *AMM27 Selenium Management*, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 9 plan implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on approximately 961–2,672 acres of modeled least bittern and white-faced ibis habitat (Table 12-9-50). However, no adverse effects of increased inundation frequency on nesting habitat would be expected because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types. Inundation would occur in the nonbreeding season and wetlands supporting habitat would not be expected to be affected by flood flows.

NEPA Effects: Periodic inundation of Yolo Bypass would not be expected to have adverse effects on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

CEQA Conclusion: Periodic inundation of Yolo Bypass would not be expected to have a significant impact on least bittern or white-faced ibis because wetland vegetation has persisted under the existing Yolo Bypass flooding regime, and changes to frequency and inundation are within the tolerance of these vegetation types.

Loggerhead Shrike

Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated because the model does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops that are not considered to be valuable habitat for the species but which were included in the model because they may provide foraging opportunities.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-9-51. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit loggerhead shrike (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objectives ASWNC1.1 and VPNC1.1, associated with CM3).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Protect at least 48,625 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species (Objective CLNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3 and CM11).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species, and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-51. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	High-value	318	318	1,281	1,281	NA	NA
	Low-value	55	55	1,231	1,231	NA	NA
Total Impacts CM1		**373**	**373**	**2,512**	**2,512**	**NA**	**NA**
CM2–CM18	High-value	5,450	26,198	376	893	777–2,423	3,823
	Low-value	1,801	17,575	97	624	672–1,996	4,315
Total Impacts CM2–CM18		**7,251**	**43,723**	**474**	**1,517**	**1,830–5,646**	**8,138**
Total High-value		**5,768**	**26,516**	**1,657**	**2,174**		
Total Low-value		**1,856**	**17,630**	**1,328**	**1,855**		
TOTAL IMPACTS		**7,624**	**44,096**	**2,986**	**4,029**		

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 9 conservation measures would result in the combined permanent loss or conversion and temporary loss of up to 48,125 acres of modeled habitat for loggerhead shrike (28,690 acres of which would be high-value habitat, Table 12-9-51). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass fisheries improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), channel margin enhancement (CM6), riparian restoration, (CM7), grassland restoration (CM8), vernal pool and wetland restoration (CM9), nontidal marsh restoration (CM10), natural communities enhancement and management (CM11) and construction of conservation hatcheries (CM18). The majority of habitat loss (33,244 acres) would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 1,599 acres of high-value loggerhead shrike habitat (318 acres of permanent loss, 1,281 acres of temporary loss). In addition, 1,286 acres of low-value habitat would be removed (55 acres of permanent loss or conversion, 1,231 acres of temporary loss or conversion, Table 12-9-51). These losses would occur at numerous locations where dredging, construction of operable barriers and canals, and channel enlargement would be undertaken. Other impacts would occur from potential borrow and spoil sites, access roads, barge unloading facilities, and intake and fish screen construction areas. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*.

  Loggerhead shrikes nest in high abundance in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. The CM1 construction footprint for the canal that would be constructed south of the Clifton Court Forebay overlaps with two loggerhead shrike occurrences. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on nesting loggerhead shrikes. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would result in the combined permanent and temporary loss of up to 1,274 acres of high-value loggerhead shrike habitat (898 acres of permanent loss, 376 acres of temporary loss) in the Yolo Bypass in CZ 2. In addition, 182 acres of low-value habitat would be removed (85 acres of permanent loss, 97 acres of temporary loss). The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20,880 acres of high-value loggerhead shrike habitat and 12,364 acres of low-value habitat. The majority of the acres lost would consist of cultivated lands in CZs 1, 2, 4, 5, 6, and/or 7. Grassland losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough. Losses of alkali seasonal wetland complex habitat would likely occur in the south end of the Yolo Bypass and on the northern fringes of Suisun Marsh.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 1,450 acres of high-value loggerhead shrike habitat (933 permanent, 517 temporary). These losses would be expected after the first 10 years of Alternative 9 implementation along the San Joaquin River and other major waterways in CZ 7.

- *CM7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 370 acres of high-value loggerhead shrike habitat as part of tidal restoration and 1,489 acres as part of seasonal floodplain restoration. In addition, 503 acres of low-value habitat would be removed as a part of tidal restoration and 1,971 acres would be removed as part of seasonal floodplain restoration through CM7.

- *CM8 Grassland Natural Community Restoration* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Temporary construction-related disturbance of grassland habitat would result from implementation of CM8 and CM9 in in CZs 1, 2, 4, 5, 7, 8, and 11. However, all areas would be restored after the construction periods. Grassland restoration would be implemented on agricultural lands that also provide habitat for loggerhead shrike and would result in the conversion of 1,849 acres of cultivated lands to high-value grassland.

- *CM10 Nontidal Marsh Restoration*: Implementation of CM10 would result in the permanent removal of 705 acres of high-value loggerhead shrike habitat and 735 acres of low-value loggerhead shrike habitat.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. CM11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. However, approximately 50 acres of grassland habitat would be lost from the construction of trails and facilities.

  Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If the species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects.

- *CM18 Conservation Hatcheries*: Implementation of CM18 would remove up to 35 acres of high-value loggerhead shrike habitat for the development of a delta and longfin smelt conservation hatchery in CZ 1. Hatchery construction is expected to occur within the first 10 years of Plan implementation.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7, Mitigation Measure BIO-75, and conservation actions as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 3,184 acres of low-value habitat would be removed or converted in the near-term (CM1, 1,286 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4).

Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1. Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would be available to address the adverse effect of near-term high-value habitat loss. With the management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential effect from the loss of low-value loggerhead shrike foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the combined permanent of and temporary effects on 28,690 acres of high-value habitat and 19,485 acres of low-value loggerhead shrike habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7 Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

NEPA Effects: The loss of loggerhead shrike habitat and potential mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM8, CM9, and CM11, guided by biological goals and objectives and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, and with implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, which would be available to guide the near-term protection and management of cultivated lands, the effects of habitat loss on loggerhead shrike under Alternative 9 would not be adverse. Loggerhead shrike is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 7,425 acres (5,768 permanent, 1,657 temporary) of high-value habitat for loggerhead shrike in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 1,599 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—5,826 acres). In addition, 3,184 acres of low-value habitat would be removed or converted in the near-term (CM1, 1,286 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management* and *CM18 Conservation Hatcheries*—1,898 acres).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 3,198 acres should be protected to compensate for the loss of high-value habitat from CM1. The near-term effects of other conservation actions would require 11,652 acres of protection to compensate for the loss of high-value shrike habitat using the same typical NEPA and CEQA ratio (2:1 protection for the loss of high-value habitat). The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,400 acres of non-rice cultivated lands (Table 3-4 in Chapter 3). These conservation actions are associated with CM3, CM8, and CM9 and would occur in the same timeframe as the construction and early restoration losses.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZs 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike. These Plan objectives represent performance standards for considering the effectiveness of conservation actions.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The combined acres of restoration and protection of 3,660 acres of grassland, vernal pool complex, and alkali seasonal wetland contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 and other near-term effects on loggerhead shrike high-value habitat with the consideration that some portion of the 15,400 acres of cultivated lands protected in the near-term timeframe would include suitable high-value crop types for loggerhead shrike. Sufficient acreage of the protected cultivated lands would need to be managed in pasture, alfalfa, or grain and hay crops such that the near-term impacts on high-value habitat were compensated for at a ratio of 2:1. The implementation of Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, would reduce the impact of near-term high-value habitat loss to a less-than-significant level.

With the acres of habitat protection and restoration described above, in addition to Mitigation Measure BIO-138, *Compensate for the Near-term Loss of High-Value Loggerhead Shrike Habitat*, Alternative 9 would not result in a substantial adverse effect through loss of high-value habitat. The management and enhancement of cultivated lands including insect prey enhancement through CM3 and CM11, the protection of shrubs and establishment of hedgerows within protected cultivated lands would compensate for any potential substantial impact from the loss of low-value loggerhead shrike foraging habitat. In addition, AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid potentially significant impacts on nesting individuals. With these measures in place, Alternative 9 would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, Alternative 9 would have a less-than-significant impact on loggerhead shrike.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the combined permanent of and temporary effects on 28,690 acres of high-value habitat and 19,485 acres of low-value loggerhead shrike habitat over the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM7, Riparian Natural Community Restoration, CM8 Grassland Natural Community Restoration,* and *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* to protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3). Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2). Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would create larger, more expansive patches of high-value habitat for loggerhead shrike and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities Enhancement and Management*, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 48,625 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of valley/foothill riparian natural community. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. The loggerhead shrike is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this potential impact to a less-than–significant level.

In the absence of other conservation actions, the effects on loggerhead shrike habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 9's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-138, *Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat*, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of loggerhead shrike. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on loggerhead shrike.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-138: Compensate for the Near-Term Loss of High-Value Loggerhead Shrike Habitat

Because the BDCP does not include acreage commitments for the protection of crop types in the near-term time period, DWR will manage and protect sufficient acres of cultivated lands such as pasture, grain and hay crops, or alfalfa as high-value loggerhead shrike habitat such that the total acres of high-value habitat impacted in the near-term timeframe are mitigated at a ratio of 2:1. Additional grassland protection, enhancement, and management may be substituted for the protection of high-value cultivated lands.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on loggerhead shrike.

CEQA Conclusion: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike as a result of the project. Therefore, the construction and operation of new transmission lines under Alternative 9 would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of Plan Implementation on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on loggerhead shrike as a result of Alternative 9 implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality. The loggerhead shrike is not a covered species under the BDCP, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 9 implementation could have a significant impact on the species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from Fremont Weir operations (*CM2 Yolo Bypass Fisheries Enhancement*) would increase the frequency and duration of inundation on 1,830–5,646 acres of modeled loggerhead shrike habitat (consisting of approximately 777–2,423 acres of high-value habitat; Table 12-9-51).

Based on hypothetical footprints, implementation of *CM5 Seasonally Inundated Floodplain Restoration* could result in the periodic inundation of up to approximately 8,138 acres of modeled habitat (Table 12-9-51), consisting of 3,823 acres of high-value and 4,315 acres of low-value habitat.

Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

NEPA Effects: Periodic inundation of floodplains would not result in an adverse effect on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

CEQA Conclusion: Periodic inundation of floodplains would result in a less-than-significant impact on loggerhead shrike from the modification of habitat. Reduced foraging habitat availability may be expected during the fledgling period of the nesting season due to periodic inundation. However, increased frequency and duration of inundation would occur during the nonbreeding season.

Song Sparrow "Modesto" Population

The Modesto song sparrow is common and ubiquitous throughout the study area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-9-52. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit Modesto song sparrow (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM7).
- Protect at least 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Create 500 acres of managed wetlands in CZs 3, 4, 5, or 6 (Objectives GSHC1.3 and GSHC1.4, associated with CM10).
- Increase prey availability and accessibility for grassland-foraging species (Objectives ASWNC2.4, VPNC2.5, and GNC2.4, associated with CM11).
- Maintain and protect the small patches of important wildlife habitats that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Establish 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands at a minimum rate of 400 linear feet per 100 acres (Objective SH2.2, associated with CM3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs and Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-52. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	133	133	418	418	NA	NA
Total Impacts CM1		**133**	**133**	**418**	**418**	**NA**	**NA**
CM2–CM18	Nesting	2,444	3,253	133	169	81–158	284
Total Impacts CM2–CM18		**2,444**	**3,253**	**133**	**169**	**81–158**	**284**
TOTAL IMPACTS		**2,2,577**	**3,386**	**551**	**587**	**81–158**	**284**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 3,973 acres of modeled habitat for Modesto song sparrow (of which 3,386 acres would be a permanent loss and 587 acres would be a temporary loss of habitat, Table 12-9-52). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5). Habitat enhancement and management activities (CM11), which would include ground disturbance and removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 551 acres of modeled Modesto song sparrow habitat (133 acres of permanent loss, 418 acres of temporary loss) from CZ 4, 5, 6, 7, and 8. Most of the permanent loss would occur as wider and deeper channels are dredged in Middle River and Victoria Canal, and as operable barriers and new Sacramento River diversions are constructed in various waterways across the Delta. Temporary losses of habitat would occur primarily along Middle River between Victoria Canal and Mildred Island, where large dredging work areas and operable barrier work areas would be placed. Some of this vegetation may be temporarily removed as dredging progresses, while other areas could remain in place but be temporarily affected by sedimentation and equipment movement associated with dredging. The Modesto song sparrow is ubiquitous throughout the study area. The CM1 construction footprint of permanent impacts overlaps with 63 occurrences of Modesto song sparrow. Permanent impacts include the construction of the canal south of Clifton Court Forebay, channel dredging, instream island dredging, and channel enlargement in Middle River and Victoria Canal, an operable barrier, and a fish screen area. The CM1 footprint of temporary impacts overlaps with 102 occurrences of Modesto song sparrow and the majority of these impacts would be a result of dredging work areas. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address potential effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Construction of the water conveyance facilities would occur in the near-term timeframe.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement would permanently remove 143 acres of modeled Modesto song sparrow habitat in the Yolo Bypass in CZ 2. In addition, 133 acres of habitat would be temporarily removed. These losses would occur in the near-term timeframe and primarily consist of valley/foothill riparian natural community and managed wetland. The loss is expected to occur during the first 10 years of Alternative 9 implementation.

- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated loss of 3,066 acres of modeled Modesto song sparrow habitat by the late long-term timeframe.

- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of setback levees to restore seasonally inundated floodplain would permanently and temporarily remove approximately 80 acres of modeled Modesto song sparrow habitat (44 permanent, 36 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7. The BDCP is expected to restore approximately 5,000 acres of valley/foothill riparian natural community. These lands would be managed as a mosaic of seral stages, age classes, and plant heights, some of which would provide suitable nesting habitat for Modesto song sparrow.

- *CM6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 20 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.

- *CM11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP.

Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these effects.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs, and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 3,128 acres of modeled habitat (2,557 permanent, 551 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 551 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 551 acres of suitable habitat should be restored/created and 551 acres should be protected to compensate for the CM1 losses of 551 acres of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding adverse effects of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 3,973 acres (3,386 acres of permanent loss, 587 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and

CM10 Nontidal Marsh Restoration to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of Modesto song sparrow habitat and potential mortality of this special-status species under Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM6, CM7, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction period, the effects of habitat loss on Modesto song sparrow under Alternative 9 would not be adverse. The Modesto song sparrow is not a covered species under the BDCP, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. Mitigation Measure BIO-75 would be available to address this effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 3,128 acres of modeled habitat (2,557 permanent, 551 temporary) for Modesto song sparrow in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 551 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—2,577 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 551 acres of suitable habitat should be restored/created and 551 acres should be protected to compensate for the CM1 losses of 551 acres of Modesto song sparrow habitat. The near-term effects of other conservation actions would remove 2,577 acres of modeled habitat, and therefore require 2,577 acres of restoration/creation and 2,577 acres of protection of Modesto song sparrow habitat using the same typical NEPA and CEQA ratios (1:1 for restoration/creation and 1:1 for protection).

The BDCP has committed to near-term goals of protecting 750 acres and restoring 800 acres of the valley/foothill riparian natural community, restoring 2,000 acres of tidal freshwater emergent wetland, restoring 500 acres of managed wetland, and restoring 400 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM7, and CM10 and would occur in the same timeframe as the construction and early restoration losses, thereby avoiding a significant impact of habitat loss on Modesto song sparrow. The majority of the riparian restoration acres would occur in CZ 7 as part of a reserve system with extensive wide bands or large patches of valley/foothill riparian natural community (Objectives VFRNC1.1 and VFRNC1.2 in BDCP Chapter 3, *Conservation Strategy*) and would provide suitable Modesto song sparrow nesting habitat. The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan also includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2).

The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to have a less-than-significant impact on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests were detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Late Long-Term Timeframe

Alternative 9 as a whole would result in the permanent loss of and temporary effects on 3,973 acres (3,386 acres of permanent loss, 587 acres of temporary loss) of modeled Modesto song sparrow habitat during the term of the Plan. The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration,* and *CM10 Nontidal Marsh Restoration* to protect 750 acres and restore 5,000 acres of the valley/foothill riparian natural community, restore 24,000 acres of tidal freshwater emergent wetland, restore 500 acres of managed wetland, and restore 1,200 acres of nontidal marsh in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). Additional acres of valley/foothill riparian habitat would be restored as a component of channel margin enhancement actions (CM6) along 20 miles of river and slough channels in the Delta, some of which would be expected to support nesting habitat for Modesto song sparrow. Of the 5,000 acres of restored riparian natural communities, a minimum of 3,000 acres of valley/foothill riparian would be restored within the seasonally inundated floodplain, and 1,000 acres would be managed as dense early to mid-successional riparian forest (Objectives VFRNC1.1 and VFRNC1.2). Goals and objectives in the Plan for riparian restoration also include the maintenance and enhancement of structural heterogeneity (Objective VFRNC2.1) which would provide suitable nesting habitat for Modesto song sparrow.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The nontidal marsh restoration would occur in CZs2, 4, and/or 5, and the managed wetland restoration would occur in CZs 3, 4, 5, or 6. Both the nontidal marsh and managed wetland restoration are associated with CM10 and would provide nesting habitat for Modesto song sparrow.

The Plan includes commitments to protect patches of important wildlife habitat on cultivated lands such as trees and shrubs along borders and roadside, riparian corridors, and wetlands (Objective CLNC1.3). In addition, 20- to 30-foot-wide hedgerows would be established along field borders and roadsides, which would provide additional habitat for the species (Objective SH2.2). The management of protected grasslands to increase insect prey through techniques such as the avoidance of use of pesticides (Objectives ASWNC2.4, VPNC2.5, and GNC2.4) would provide further benefits to foraging Modesto song sparrows. These Plan objectives represent performance standards for considering the effectiveness of conservation actions. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on Modesto song sparrow, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS. Modesto song sparrow is not a covered species under the BDCP. For the BDCP to minimize direct mortality of individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Considering Alternative 9's protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

NEPA Effects: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

CEQA Conclusion: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow population.

Impact BIO-144: Indirect Effects of Plan Implementation on Modesto Song Sparrow

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 including *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* contains provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on Modesto song sparrow.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on Modesto song sparrow.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on Modesto song sparrow from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on Modesto song sparrow as a result of constructing the Alternative 9 water conveyance facilities could adversely affect individuals in the absence of other conservation actions. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would minimize this adverse effect.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for Modesto song sparrow, once site specific sampling and other information could be developed.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: Indirect effects on Modesto song sparrow as a result of constructing the water conveyance facilities could have a significant impact on these species. The incorporation of AMM1–AMM7 into the BDCP and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of Modesto song sparrow to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to the species. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in *CM12 Methylmercury Management* would address the potential impacts of methylmercury levels in restored tidal marsh in the study area.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium. With implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, the impact of potential increased exposure to selenium would be less than significant.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 81–158 acres of modeled Modesto song sparrow habitat. However, inundation would occur during the nonbreeding season. Reduced foraging habitat availability would be expected during the fledgling period of the nesting season due to periodic inundation.

Based on hypothetical floodplain restoration, construction of setback levees from seasonally inundated floodplain restoration (CM5) could result in periodic inundation of up to approximately 284 acres of Modesto song sparrow modeled habitat (Table 12-9-52).

The periodic inundation of the Yolo Bypass (CM2) and of seasonal floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat, but may reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March).

NEPA Effects: Periodic effects of inundation would not result in an adverse effect on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

CEQA Conclusion: Periodic effects of inundation would have a less-than-significant impact on Modesto song sparrow because increased frequency and duration of inundation would be expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support Modesto song sparrow habitat.

Bank Swallow

Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70–90% of the bank swallow population in California nests along the Sacramento and Feather Rivers upstream of the study area (Bank Swallow Technical Advisory Committee 2013). However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Construction and restoration associated with Alternative 9 conservation measures would not result in any direct loss of modeled habitat for bank swallow (Table 12-9-53). However, indirect effects of noise and visual disturbance from *CM2 Yolo Bypass Fisheries Enhancement* and *CM4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they are present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat. As explained below, impacts on bank swallow under Alternative 9 would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-9-53. Changes in Bank Swallow Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Breeding	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**	**NA**	**NA**
CM2–CM18	Breeding	0	0	0	0	0	0
Total Impacts CM2–CM18		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities from *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in CZ 2 and CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

NEPA Effects: Construction activities associated with habitat restoration could adversely affect bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in adverse effects on bank swallows if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this effect.

CEQA Conclusion: Construction activities associated with habitat restoration could result in a significant impact on bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, BDCP proponents will not construct conservation components during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWRs will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after March when the swallows have nested and layed eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses, which resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento River (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Chapter 5, Section 5.3.1, *Methods for Analysis*, for a description of the model).

On the Sacramento River at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 9 could increase between April and August in average water years based on modeling assumptions (Table 1 in Section 11C.9.1.1 and Table 3 Section 11C.9.1.2 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) which could lead to inundation of active colonies.

However, model outputs indicate that the flows under Existing Conditions and the predicted flows in the late long-term without the project (NAA) show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (Table 15 in Section 11C.9.1.8 and Table 17 in Section 11C.9.1.9 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). In addition, at the Keswick flow gauge on the Sacramento River in above normal water years (Table 1 in Section 11C.9.1.1 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*) flows are predicted to be greater than 14,000 cfs during the breeding season, which could lead to bank collapse. However, flows of this height are recorded under Existing Conditions at this flow gauge and are also predicted for the late long-term without the project (NAA).

***NEPA Effects*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 9 would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of effects on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

***CEQA Conclusion*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies the breeding season, and predicted flows under Alternative 9 would not differ substantially from those under Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitoring[1] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would result in loss of active nest sites or degradation of available nesting habitat, and the extent to which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the

[1] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

The habitat model used to assess impacts on yellow-headed blackbird consists of nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-9-54. Full implementation of Alternative 9 would include the following biological objectives over the term of the BDCP that would benefit yellow-headed blackbird (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Restore or create at least 24,000 acres of tidal freshwater emergent wetland in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1, associated with CM4).
- Create at least 1,200 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities (Objective NFEW/NPANC1.1, associated with CM10).
- Protect and enhance at least 8,100 acres of managed wetland, at least 1,500 acres of which are in the Grizzly Island Marsh Complex (Objective MWNC1.1, associated with CM3).
- Protect at least 8,000 acres of grassland, with at least 2,000 acres protected in CZ 1, at least 1,000 acres protected in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed among CZs 1, 2, 4, 5, 7, 8, and 11 (Objective GNC1.1, associated with CM3).
- Restore at least 2,000 acres of grasslands (Objective GNC1.2, associated with CM8).
- Protect at least 150 acres of alkali seasonal wetland and at least 600 acres of existing vernal pool complex in CZs 1, 8, and/or 11 (Objective ASWNC1.1, Objective VPNC1.1, associated with CM3).
- Maintain and protect the small patches of important wildlife habitats that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Objective CLNC1.3, associated with CM3).
- Protect at least 11,050 acres of high- to very high-value breeding-foraging habitat (Table 12-9-38) in CZs 1, 2, 3, 4, 7, 8, or 11 (Objective TRBL1.3, associated with CM3).
- Increase prey abundance and accessibility for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species, and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-54. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 9

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Nesting	72	72	169	169	NA	NA
	Foraging	327	327	1,288	1,288	NA	NA
Total Impacts CM1		**399**	**399**	**1,457**	**1,457**	**NA**	**NA**
CM2–CM18	Nesting	5,814	13,902	45	46	961–2,678	18
	Foraging	5,612	26,673	376	905	368–1,476	2,701
Total Impacts CM2–CM18		**11,426**	**40,575**	**421**	**951**	**1,495–4,394**	**2,719**
Total Nesting		**5,886**	**13,974**	**214**	**215**	**961–2,678**	**18**
Total Foraging		**5,939**	**27,000**	**1,664**	**2,193**	**368–1,476**	**2,701**
TOTAL IMPACTS		**11,825**	**40,974**	**4,878**	**2,408**	**1,495–4,394**	**2,719**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 43,382 acres of suitable habitat for yellow-headed blackbird (14,189 acres of nesting habitat and 29,193 acres foraging habitat; Table 12-9-54). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), floodplain restoration (CM5), riparian restoration (CM7), grassland restoration (CM8), marsh restoration (CM10), and construction of conservation hatcheries (CM18). Habitat enhancement and management activities (CM11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects, and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 water conveyance facilities would result in the combined permanent and temporary loss of up to 241 acres of yellow-headed blackbird nesting habitat (72 acres of permanent loss and 169 acres of temporary loss). In addition, 1,615 acres of foraging habitat would be removed (327 acres of permanent loss, 1,288 acres of temporary loss, Table 12-9-54). Impacts from CM1 would occur in the central delta in CZ 4, 5, 6, 7, and 8. Most of the loss of nesting habitat would occur at the channel dredging sites within the Middle River and Victoria Canal. Middle River dredging would occur from Victoria Canal north to Mildred Island, while Victoria Canal dredging would extend from Middle River westward to Old River. Smaller areas would be permanently lost at operable barrier sites adjacent to Middle River and San Joaquin River. impacts on foraging habitat would occur from the construction of the canals in CZ 8 east and south of Clifton Court Forebay and other conveyance structures in CZ 4, 5, 6, 7, and 8. Temporary impacts would primarily occur from borrow and spoil areas and temporary work areas. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for CM1. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address potential effects on yellow-headed blackbirds if they were to nest in or adjacent to construction areas. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations. Impacts from CM1 would occur within the first 10 years of Alternative 9 implementation.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement (CM2) would result in the permanent removal of 29 acres of breeding habitat and 113 acres of nonbreeding habitat for yellow-headed blackbird. In addition, CM2 would result in the temporary loss of 43 acres of breeding habitat for the species. Impacts from CM2 would primarily occur in the near-term timeframe.

- *CM4 Tidal Natural Communities Restoration*: Site preparation and inundation from CM4 would permanently remove or convert an estimated 4,801 acres of breeding habitat. In addition, 3,282 acres of non-breeding habitat would be lost or converted as a result of tidal restoration. However, the resulting 65,000 acres of tidal natural communities would also provide habitat for the species, 24,000 acres of which would be tidal freshwater natural communities providing breeding habitat for yellow-headed blackbird.

- *CM5 Seasonally Inundated Floodplain Restoration/CM7: Riparian Natural Community Restoration:* Construction of setback levees to restore seasonally inundated floodplain and riparian restoration actions (CM5) would permanently and temporarily remove approximately 2,477 acres of suitable yellow-headed blackbird habitat consisting of 2 acres of breeding habitat and 2,475 acres of nonbreeding habitat.

- *CM8 Grassland Natural Community Restoration:* Restoration of grassland is expected to be implemented on agricultural lands and would result in the conversion of 230 acres of yellow-headed blackbird agricultural foraging habitat to grassland foraging habitat in CZs 1, 8, and/or 11. If agricultural lands supporting higher value foraging habitat than the restored grassland were removed, there would be a loss of yellow-headed blackbird foraging habitat value. CM8 would result in the restoration of 2,000 acres of grassland foraging habitat in the Plan Area.

- *CM10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 133 acres of cultivated lands foraging habitat to nontidal marsh in CZ 2 and CZ 4. Yellow-headed blackbird nesting habitat may develop along the margins of restored nontidal marsh and restoration would also provide foraging habitat for the species.

- *CM11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the Plan Area, because they would be expected to avoid contact with construction and other equipment.
- If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 6,100 acres (5,886 acres of permanent loss, 214 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 241 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Seasonally Inundated Floodplain Restoration*—5,859 acres). In addition, 7,603 acres (5,939 acres of permanent loss, 1,664 acres of temporary loss) of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 1,615acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—5,988 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 241 acres of nesting habitat should be restored/created and 241 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 1,615 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,600 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention*

Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 14,189 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 29,193 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration, CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective

SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (BDCP Chapter 3, Table 3.3-6). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of yellow-headed blackbird habitat and potential direct mortality of this special-status species associated with Alternative 9 would represent an adverse effect in the absence of other conservation actions. With habitat protection and restoration associated with CM3, CM4, CM8, CM10, and CM11, guided by biological goals and objectives and by AMM1–AMM7, which would be in place throughout the construction phase, the effects of habitat loss would not be adverse under Alternative 9. The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA. Alternative 9 would remove 6,100 acres (5,886 acres of permanent loss, 214 acres of temporary loss) of yellow-headed blackbird nesting habitat in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 241 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, and *CM5 Floodplain Restoration*—5,859 acres). In addition, 7,603 acres (5,939 acres of permanent loss, 1,664 acres of temporary loss) of yellow-headed blackbird foraging habitat would be removed or converted in the near-term (CM1, 1,615 acres; *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal*

Natural Communities Restoration, *CM5 Seasonally Inundated Floodplain Restoration, CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM18 Conservation Hatcheries*—,988,985 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 241 acres of nesting habitat should be restored/created and 241 acres should be protected to compensate for the CM1 losses of yellow-headed blackbird nesting habitat. In addition, 1,615 acres of foraging habitat should be protected to compensate for the CM1 losses of yellow-headed blackbird foraging habitat. The near-term effects of other conservation actions would require 5,859 acres each of restoration and protection of breeding habitat and 5,988 acres of protection of foraging habitat using the same typical NEPA and CEQA ratios (1:1 for restoration and 1:1 for protection of nesting and 1: protection of foraging habitat).

The BDCP has committed to near-term goals of restoring 8,850 acres of tidal freshwater emergent wetland, protecting 4,800 acres of managed wetland, protecting 25 acres and restoring 900 acres of nontidal marsh, protecting 2,000 acres and restoring 1,140 acres of grassland natural community, protecting 400 acres of vernal pool complex, protecting 120 acres of alkali seasonal wetland complex, and protecting 15,600 acres of cultivated lands in the Plan Area (Table 3-4 in Chapter 3, *Description of Alternatives*). These conservation actions are associated with CM3, CM4, CM8, and CM10 and would occur in the same timeframe as the construction and early restoration losses.

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The 4,800 acres of managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 900 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3).

At least 15,400 acres of cultivated lands that provide habitat for covered and other native wildlife species would be protected in the near-term time period (Objective CLNC1.1), much of which would provide foraging habitat for yellow-headed blackbird. The acres of restoration and protection contained in the near-term Plan goals and the additional detail in the biological objectives satisfy the typical mitigation that would be applied to the project-level effects of CM1 on yellow-headed blackbird habitat, as well as mitigate the near-term effects of the other conservation measures.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce potential impacts on nesting yellow-headed blackbird to a less-than-significant level.

Late Long-Term Timeframe

The study area supports approximately 82,005 acres of modeled nesting habitat and 333,956 acres of modeled foraging habitat for yellow-headed blackbird. Alternative 9 as a whole would result in the permanent loss of and temporary effects on 14,189 acres of potential nesting habitat (17% of the potential nesting habitat in the study area) and the loss or conversion of 29,193 acres of foraging habitat (9% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures.

The Plan includes conservation commitments through *CM3 Natural Communities Protection and Restoration, CM4 Tidal Natural Communities Restoration*, *CM8 Grassland Natural Community Restoration,* and *CM10 Nontidal Marsh Restoration* to protect and enhance at least 8,100 acres of managed wetland, restore or create at least 24,000 acres of tidal freshwater emergent wetland, create or restore at least 1,200 acres of nontidal marsh, protect 8,000 acres and restore 2,000 acres of grassland natural community, protect 600 acres of vernal pool complex, protect 150 acres of alkali seasonal wetland complex, and protect 48,625 acres of cultivated lands that provide suitable habitat for native wildlife species (Table 3-4 in Chapter 3, *Description of Alternatives*).

The tidal freshwater emergent wetland would be restored in CZs 1, 2, 4, 5, 6, and/or 7 (Objective TFEWNC1.1 in BDCP Chapter 3, *Conservation Strategy*) and would be restored in a way that creates topographic heterogeneity and in areas that increase connectivity among protected lands (Objective TFEWNC2.2). The managed wetland would be protected and enhanced in CZ 11 and would benefit yellow-headed blackbird through the enhancement of degraded areas (such as areas of bare ground or marsh where the predominant vegetation consists of invasive species such as perennial pepperweed) to vegetation such as pickleweed-alkali heath-American bulrush plant associations (Objective MWNC1.1). In addition, at least 1,200 acres of nontidal marsh would be created, some of which would provide nesting habitat for the species.

Grassland restoration and protection would occur in CZs 1, 2, 4, 5, 7, 8, and 11 (Objectives GNC1.1 and GNC1.2) Grassland protection in CZ 1, 8, and 11 would be associated with vernal pool and alkali seasonal wetland complexes (Objectives ASWNC1.1 and VPNC1.1) and would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would provide grassland foraging habitat for yellow-headed blackbird. Insect prey availability and abundance would also be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Foraging opportunities would also be improved by enhancing prey populations through the establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands (Objective SWHA2.2). Within the cultivated lands, important wildlife habitat such as grasslands, ponds, and wetlands would also be protected and maintained as part of the cultivated lands reserve system which would provide additional habitat for yellow-headed blackbird (Objective CLNC1.3). Of the 48,625 acres of cultivated lands that would be protected and enhanced by the late long-term time period (Objective CLNC1.1), 26,300 acres would be managed in moderate to high-value crop types for tricolored blackbird (BDCP Chapter 3, Table 3.3-6). These crop types include pasture, sunflower, alfalfa, and other crop types that would provide high-value foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

The yellow-headed blackbird is not a covered species under the BDCP. For the BDCP to avoid an adverse effect on individuals, preconstruction surveys for noncovered avian species would be required to ensure that nests are detected and avoided. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

In the absence of other conservation actions, the effects on yellow-headed blackbird habitat would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. This impact would be significant. Considering Alternative 9's protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts necessary to compensate for habitat lost to construction and restoration activities, and with the implementation of AMM1–AMM7 and Mitigation Measure BIO-75, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Appendix 5.J, Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would reduce the potential for yellow-headed blackbird collision with transmission lines. Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increased risk in predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increased risk in predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 9 would not result in an adverse effect on yellow-headed blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increased risk of predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 9 would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of Plan Implementation on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 1,900 to 5,250 feet from the edge of construction activities (BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 4), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat.

The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the BDCP is contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the BDCP-related mechanisms that could result in increased mercury in the foodweb, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in Appendix 5.D, *Contaminants*, of the BDCP).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *CM12 Methylmercury Management* (as revised in Appendix 11F, *Substantive BDCP Revisions*) is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. CM12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This conservation measure would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009), and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 9 restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4 and CM5) would lead to adverse effects on yellow-headed blackbird.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on yellow-headed blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury, in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

CEQA Conclusion: In the absence of other conservation actions, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 9 would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration or floodplain restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of CM12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbirdl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Indirect effects of plan implementation would represent an adverse effect on yellow-headed blackbird in the absence of other conservation measures. This would be a significant impact. With AMM1-7, AMM27, and CM12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of plan implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of plan implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass (CM2) would inundate 961–2,678 acres of nesting habitat and 368–2,678 acres of foraging habitat (Table 12-9-54). Based on hypothetical floodplain restoration, construction of setback levees for *CM5 Seasonally Inundated Floodplain Restoration* could result in periodic inundation of approximately 18 acres of nesting habitat and 2,701 acres of nonbreeding habitat (Table 12-9-54) resulting in the temporary loss of these habitats. Foraging yellow-headed blackbirds would be expected to move to adjacent suitable foraging habitat when the bypass is inundated, as they do under the current flooding regime. However, this inundation could reduce the availability of nesting habitat during years when flooding extends into the nesting season (past March). The periodic inundation of the Yolo Bypass (CM2) and of other floodplains (CM5) is expected to restore a more natural flood regime in support of wetland and riparian vegetation types that support nesting habitat.

NEPA Effects: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and although foraging habitat may be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

CEQA Conclusion: Implementation of CM2 and CM5 would result in periodic inundation of nesting and foraging habitat for yellow-headed blackbird. Periodic inundation would have a less-than-significant impact on yellow-headed blackbird because inundation is expected to take place outside of the breeding season, and although foraging habitat would be temporarily unavailable, birds would be expected to move to adjacent foraging habitat.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). The is only the second naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-9-55. Full implementation of Alternative 9 would also include biological objectives over the term of the BDCP to benefit the riparian brush rabbit (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian brush rabbit, with conservation principles involves protecting, restoring or creating, and maintaining habitat and corridors near the largest remaining fragments of habitat and extant populations; providing high-water refugia from flooding; and managing feral predators (dogs and cats) in areas occupied by the species. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted, or implement management actions that mimic those natural disturbances (Objective L2.1, associated with CM3, CM5, and CM11).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with at least 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).
- Maintain 1,000 acres of early- to mid-successional vegetation with a well-developed understory of dense shrubs on restored seasonally inundated floodplain (Objective VFRNC2.2, associated with CM5, CM7, and CM11).
- Of the 750 acres of protected valley/foothill riparian natural community protected under Objective VFRNC1.2, protect at least 200 acres of suitable riparian brush rabbit habitat (defined in CM7 Riparian Natural Community Restoration) that is occupied by the species or contiguous with occupied habitat (Objective RBR1.1, associated with 3).
- Of the 1,000 acres of early- to midsuccessional riparian habitat maintained under VFRNC2.2, maintain at least 800 acres within the range of the riparian brush rabbit (CZ 7), in areas that are adjacent to or that facilitate connectivity with occupied or potentially occupied habitat (Objective RBR1.2, associated with CM3, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain at least 300 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Objective 1.3, associated with CM3, CM7, and CM11).
- Create and maintain high-water refugia in the 300 acres of restored riparian brush rabbit habitat and the 200 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Objective RBR1.4, associated with CM7 and CM11).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Objective RBR1.5, associated with CM11).

- Of the 8,000 acres of grasslands protected under Objective GNC1.1 and the 2,000 acres of grasslands restored under Objective GNC1.2, protect or restore grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6m, associated with CM3 and CM8).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-55. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	8	8	6	6	NA	NA
	Grassland	58	58	139	139	NA	NA
Total Impacts CM1		**66**	**66**	**145**	**145**		
CM2–CM18	Riparian	0	62	0	35	0	264
	Grassland	0	44	0	20	0	423
Total Impacts CM2–CM18		**0**	**106**	**0**	**55**	**0**	**687**
TOTAL IMPACTS		**66**	**172**	**145**	**200**	**0**	**687**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

- Alternative 9 conservation measures would result in the permanent loss of up to 111 acres of riparian habitat and 261 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-9-55). The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange. Conservation measures resulting in permanent habitat loss include conveyance facilities construction (CM1), tidal natural communities restoration (CM4), and floodplain restoration (CM5). Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 9 water conveyance facilities would result in the permanent removal of approximately 8 acres of riparian habitat and 58 acres of associated grassland habitat and in the temporary removal of 6 acres of riparian habitat and 139 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-9-55). The riparian habitat that would be removed is of low value for the riparian brush rabbit as is consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low-quality for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.

- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 19 acres of riparian habitat and 18 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. The riparian habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by agricultural lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. The habitat that would be removed is not adjacent to any existing conserved lands, and is several miles north and northeast of the northernmost riparian brush rabbit record located northeast of Paradise Cut (Williams et al. 2002). Although the final footprint for tidal natural communities restoration would differ from the hypothetical footprint, compliance monitoring would be implemented to ensure that acreage limits are not exceeded, and the measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit* require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian brush rabbit.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 43 acres of riparian habitat and 26 acres of associated grassland habitat for the riparian brush rabbit in CZ 7 in the late long-term. Levee construction would also result in the temporary removal of 35 acre riparian habitat and 20 acres of grassland habitat for the riparian brush rabbit. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.

  The value of this habitat for riparian brush rabbit is high: although it consists of small patches and narrow bands of riparian vegetation, these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The hypothetical footprint for levee construction overlaps with one occurrence record for riparian brush rabbit, south of the Interstate 5/Interstate 205 interchange.

  Although the final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis, restoration of the river floodplain in CZ 7 would be targeted in the general area of the riparian brush rabbit population. Implementation of adaptive management described in *AMM25* would ensure that riparian brush rabbit habitat permanently removed as a result of floodplain restoration does not exceed the maximum allowable habitat loss for this species.

- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

  Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37 Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation-related effects on the riparian brush rabbit are expected to be minimal.

- Operations and maintenance: Ongoing maintenance of BDCP facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.

- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbit because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Tidal natural communities restoration would not result in injury or mortality of the riparian brush rabbit because tidal natural communities restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian brush rabbits: however, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during construction (AMM25).

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because the water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA.

Alternative 9 would result in permanent and temporary effects combined on 14 acres of riparian habitat and 197 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the near-term loss of riparian brush rabbit habitat would be in an area the species is unlikely to occupy in CZ 8. Habitat loss in CZ

7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 14 acres of riparian habitat should be restored, 14 acres of riparian habitat should protected, and 394 acres of grassland should be protected for riparian brush rabbit to mitigate near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian(Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (Objectives RBR1.1–RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be 14 acres of riparian habitat restored, 14 acres protected, and 394 acres of grassland protected.

The plan also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM25 Riparian Woodrat and Riparian Brush Rabbit, and AMM37 Recreation*. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 9 a whole would result in permanent and temporary effects combined on 111 acres of modeled riparian habitat and 261 acres of modeled grassland habitat for riparian brush rabbit, representing 4% and 8% of the riparian and grassland modeled habitat. The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (Objective RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.F, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

NEPA Effects: In the near-term, the loss of riparian brush rabbit habitat under Alternative 9 would not be adverse because there is little likelihood of riparian brush rabbits being present and the BDCP has committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of riparian brush rabbit riparian and grassland habitat associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6, AMM10, AMM25, and AMM37, the effects of Alternative 9 as a whole on riparian brush rabbit would not be adverse.

CEQA Conclusion:

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would be less than significant under CEQA.

Alternative 9 would result in permanent and temporary effects combined on 14 acres of riparian habitat and 197 acres of grassland habitat for riparian brush rabbit in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the near-term loss of riparian brush rabbit habitat would be in an area unlikely to be occupied by the species in CZ 8. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term timeframes. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses resulting from CM2–CM18.

Typical CEQA project-level mitigation ratios for those natural communities that would be affected and that are identified in the biological goals and objectives for riparian brush rabbit in Chapter 3 of the BDCP would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland. Using these ratios would indicate that 14 acres of riparian habitat should be restored, 14 acres of riparian habitat should protected, and 394 acres of grassland should be protected for riparian brush rabbit to mitigate CM1 losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and an unknown number of associated acres of grassland and protection of 750 acres of riparian (Objective VFRNC1.2) with an unknown number of associated acres of grassland (Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RBR1.1–RBR1.6) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be 14 acres or riparian habitat protected, 14 acres of riparian habitat restored, and 394 acres of grassland habitat protected.

The plan also contains commitments to implement AMM1–AMM7, AMM10, AMM25, and AMM37. These AMMs contain elements that avoid or minimize the risk of BDCP activities affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

There are 6,012 acres of modeled riparian brush rabbit habitat in the Plan Area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 9 would result in permanent and temporary effects combined on 111 acres of modeled riparian habitat and 261 acres of modeled grassland habitat for riparian brush rabbit, representing 4% and 8% of the riparian and grassland modeled habitat.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RBR1.2 requires that at least 800 acres of early- to midsuccessional riparian natural community be conserved in CZ 7, in areas that are adjacent to or that facilitate connectivity with existing occupied or potentially occupied habitat. This would consist of 200 acres of protected habitat (Objective RBR1.1) and 600 acres of restored habitat. The 800 acres to be conserved would consist of early successional riparian vegetation suitable for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The species-specific objectives further require that the 200 acres of protected riparian habitat (Objective RBR1.4) and at least 300 acres of the restored riparian habitat (Objective RBR1.3) meet more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding. In protected riparian areas that are occupied by riparian brush rabbit, nonnative predators that are known to prey on riparian brush rabbit would be monitored and controlled (Objective RBR1.5).

In addition to restoration and protection of riparian habitat for the riparian brush rabbit, the BDCP would protect, and, if necessary, create or restore grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees (Objective RBR1.6). These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. The actual acreage of grassland to be restored or protected for riparian brush rabbit would depend on site-specific needs adjacent to restored and protected riparian habitat (CM3). Grasslands on the landward side of levees adjacent to restored floodplain would be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit (Objective RBR1.6).

In addition to grasslands protected and restored outside the levees for riparian brush rabbit as needed, the floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian brush rabbit during most years. The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RBR1.4) that are designed specifically to provide flood refugia for the riparian brush rabbit (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian areas that are occupied by riparian brush rabbit (Objective RBR1.5), and controlled as needed (CM11).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian and grassland that could overlap with the species model, would result in the restoration of 800 acres of riparian and 79 acres of grassland modeled habitat for riparian brush rabbit. In addition, protection of valley/foothill riparian and grassland could overlap with the species model and would result in the protection of 200 acres of riparian and 317 acres of grassland riparian brush rabbit modeled habitat.

Only a small proportion of the lost habitat would be considered occupied and of high-value. Alternative 9 conservation measures provide for large acreages of riparian brush rabbit riparian and grassland habitat to be protected and restored, and the BDCP includes AMM1–AMM7, AMM10, AMM25, and AMM37, which are directed at minimizing or avoiding potential effects during construction and operation of the conservation measures. Overall, the BDCP would provide a substantial net benefit to the riparian brush rabbit through the increase in available habitat and habitat in protected status. These protected areas would be managed to support the species.

Considering the habitat restoration and protection associated with CM3, CM7, CM8 and CM11, guided by species-specific goals and objectives and by AMM1–AMM7, AMM10, AMM25, and AMM37, the temporary and permanent losses of riparian and grassland habitat and potential direct mortality of riparian brush rabbit as a result of implementing Alternative 9 would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. The loss of habitat and potential mortality of riparian brush rabbits would be a less-than-significant impact under CEQA.

Impact BIO-153: Indirect Effects of Plan Implementation on Riparian Brush Rabbit

Noise, lighting, and visual disturbance adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat in the study area. These construction activities would include water conveyance (including transmission line) construction in CZ 8, tidal natural communities restoration construction, and construction of setback levees. Water conveyance construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area;; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. Tidal natural communities restoration construction would also potentially affect adjacent riparian habitat and associated grassland habitat for this species: however, adverse effects on the species are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian brush rabbit. The activity most likely to result in noise, lighting, and visual disturbance to riparian brush rabbit is the construction of setback levees for floodplain restoration, which would take place in CZ 7, where the species is known to occur. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of implementing Alternative 9 would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 9 would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise, lighting, and visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 9, the BDCP would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 9 would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally Inundated Floodplain Restoration is the only covered activity expected to result in periodic inundation of riparian brush rabbit habitat. This activity would periodically inundate approximately 264 acres of riparian habitat (9% of riparian habitat in the Plan Area) and 423 acres of associated grassland habitat (14% of associated grassland habitat in the Plan Area) for the riparian brush rabbit. The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of high-value habitat for the species: although they consist of small patches and narrow bands of riparian vegetation, many of these areas are in proximity to, or contiguous with, habitat with recorded occurrences of riparian brush rabbit. The restored floodplain would include a range of elevations from lower lying areas that flood frequently (e.g., every 1 to 2 years) to higher elevation areas that flood infrequently (e.g., every 10 years or more).

Seasonal flooding in restored floodplains can result in injury or mortality of individuals if riparian brush rabbits occupy these areas and cannot escape flood waters. One recorded occurrence of riparian brush rabbit (Williams et al. 2002), just west of Stewart Road in Mossdale, is in the area that would be seasonally flooded based on the hypothetical restoration footprint.

NEPA Effects: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 9, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, Alternative 9 would not adversely affect the species.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect only a small proportion of the modeled riparian brush rabbit habitat in the study area. The overall effect of seasonal inundation on existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for covered riparian species, such as the riparian brush rabbit. Long-term management of riparian areas would ensure that refugia also exist along the edges of seasonally inundated habitat.

The adverse effects of periodic inundation on the riparian brush rabbit would be minimized through construction and maintenance of flood refugia to allow riparian brush rabbits to escape inundation. Therefore, implementing Alternative 9, including AMM1–AMM7, AMM10, AMM25, and AMM37, would not be expected to result in substantial adverse effects on riparian brush rabbit, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Periodic inundation of riparian and grassland habitat for riparian brush rabbit under Alternative 9 would have a less-than-significant impact on the species.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the BDCP area in CZ 7, south of State Route 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47). Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of riparian woodrat modeled habitat as indicated in Table 12-9-56. Tidal habitat restoration, floodplain restoration, and protection and management of natural communities could affect modeled riparian woodrat habitat. However, because the species is not known to occur in the study area it is not expected to be affected by BDCP actions unless the species were to establish in the study area over the term of the BDCP. Full implementation of Alternative 9 would also include biological objectives over the term of the BDCP to benefit the riparian woodrat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the riparian woodrat involves providing opportunities for population expansion into the Plan Area from adjacent lands to the south and southeast. The strategy focuses on restoring and maintaining suitable habitat at the southernmost end of CZ 7, providing connectivity with existing populations to the south and southeast, and creating and maintaining flood refugia. This conservation approach is consistent with the recovery plan (U.S. Fish and Wildlife Service 1998) and conservation principles (BDCP Appendix 3.E). The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Provide a range of elevations in restored floodplains that transition from frequently flooded (e.g., every 1 to 2 years) to infrequently flooded (e.g., every 10 years or more) areas to provide a range of habitat conditions, upland habitat values, and refugia from flooding during most flood events (Objective L1.5, associated with CM3, CM5, and CM8).
- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Objective L1.6, associated with CM3).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3–CM8, and CM11).
- Restore or create 5,000 acres of valley/foothill riparian natural community, with 3,000 acres occurring on restored seasonally inundated floodplain (Objective VFRNC1.1, associated with CM3 and CM7).
- Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

- Restore, maintain and enhance structural heterogeneity with adequate vertical and horizontal overlap among vegetation components and over adjacent riverine channels, freshwater emergent wetlands, and grasslands (Objective VFRNC2.1, associated with CM5, CM7, and CM11).
- Of the 5,000 acres of valley/foothill riparian natural community restored under Objective VFRNC1.1, restore/create and maintain 300 acres riparian habitat in CZ 7 that meets the ecological requirements of the riparian woodrat (i.e., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat (Objective RW1.1, associated with CM3, CM7, CM11).
- Provide and maintain high-water refugia in the 300 acres of riparian woodrat habitat restored under Objective RW1.1 through the retention, construction, and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 67 feet (Objective RW1.2, associated with CM7 and CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of the AMMs to reduce potential effects, impacts on riparian woodrat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-56. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Riparian	2	2	1	1	NA	NA
Total Impacts CM1		**2**	**2**	**1**	**1**	**NA**	**NA**
CM2–CM18	Riparian	0	51	0	33	0	203
Total Impacts CM2–CM18		**0**	**51**	**0**	**33**	**0**	**203**
TOTAL IMPACTS		**2**	**53**	**1**	**34**	**0**	**203**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

Alternative 9 conservation measures would result in the permanent loss of up to 53 acres of habitat and temporary loss of up to 34 acres of habitat for riparian woodrat (Table 12-9-56). Construction of Alternative 9 water conveyance facilities (CM1) would not affect modeled habitat; however, tidal natural communities restoration (CM4) and seasonally inundated floodplain restoration (CM5) would remove habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Development of Alternative 9 water conveyance facilities would result in the permanent and temporary removal of approximately 3 acres of modeled habitat for riparian woodrat in CZ 8 (Table 12-9-56). The modeled habitat that would be removed is of low value for the riparian woodrat as it consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay in CZ 8. Trapping efforts conducted for the riparian woodrat in this area were negative (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 9 construction locations.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled habitat for the riparian woodrat in CZ 7. This habitat is of low value, consisting of a small, isolated patch surrounded by agricultural lands, and the species has a relatively low likelihood of being present in these areas. The measures described in *AMM25 Riparian Woodrat and Riparian Brush Rabbit*, require that tidal natural communities restoration avoid removal of any habitat occupied by the riparian woodrat as determined by presence/absence surveys. Because the estimates of habitat loss due to tidal inundation are based on projections of where restoration may occur, actual habitat loss is expected to be lower because sites would be selected to minimize effects on riparian woodrat.
- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the permanent removal of approximately 41 acres of modeled habitat for the riparian woodrat in CZ 7. The value of this habitat for riparian woodrat is moderate. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River. There are two species occurrences immediately south of CZ 7, one of which is less than 1.5 mile from the southernmost patch of riparian habitat potentially affected by levee construction.

  The final floodplain restoration design would differ from the hypothetical footprint used for this effects analysis. However, monitoring and adaptive management described in *CM11 Natural Communities Enhancement and Management a*nd AMM25 *Riparian Woodrat and Riparian Brush Rabbit* would ensure that riparian woodrat habitat permanently removed as a result of floodplain restoration does not exceed the amount estimated based on the hypothetical footprint. Habitat loss is expected to be lower than 41 acres because sites would be selected and restoration designed to minimize effects on the riparian woodrat. If natural flooding is insufficient to maintain appropriate riparian woodrat vegetation structure, the vegetation would be actively managed to provide suitable habitat structure as described in *CM11 Natural Communities Enhancement and Management.*

  Levee construction would also result in the temporary removal of 33 acres of modeled habitat for the riparian woodrat. Although the effects are considered temporary, 5 years to several decades may be required for ecological succession to occur and for restored riparian habitat to replace the function of habitat that has been affected.
- *CM11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in CM11 that are designed to enhance wildlife values in BDCP protected habitats may result in localized ground disturbances that could temporarily remove small

amounts of riparian woodrat habitat. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian woodrat habitat and are expected to result in overall improvements to and maintenance of riparian woodrat habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: The only ongoing effects on the riparian woodrat are those potentially resulting from habitat enhancement and management activities. Enhancement and management actions in riparian woodrat habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities may result in harassment of riparian woodrats through noise and visual disturbance which would be minimized with implementation of AMM1–AMM7, AMM10, and AMM25.

- Injury and direct mortality: Construction vehicle activity is not likely to result in injury or mortality of individual riparian woodrats because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (BDCP Appendix 3.E, *Conservation Principles for the Riparian Woodrat and Riparian Brush Rabbit*). Tidal natural communities restoration would not result in injury or mortality of the riparian woodrats because under AMM25 tidal natural communities restoration projects would be designed to avoid occupied riparian woodrat habitat and if that is not possible to trap and relocate the species. Activities associated with construction of setback levees for floodplain restoration could result in injury or mortality of riparian woodrats; however, preconstruction surveys, construction monitoring, and other measures would be implemented under AMM25 to avoid and minimize injury or mortality of this species during construction, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. If occupied riparian woodrat habitat cannot be avoided, mortality would be avoided through implementation of a trapping and relocation program. The program would be developed in coordination with USFWS, and relocation would be to a site approved by USFWS prior to construction activities.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Alternative 9 would result in permanent and temporary effects on 3 acres of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction in CZ 8, and would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods.

Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical NEPA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 3 acres of riparian habitat should be restored and 3 acres of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be not be adverse under NEPA, because no riparian woodrat habitat would be lost and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the BDCP's commitment to *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 9 as a whole would result in the permanent loss of and temporary removal of 87 acres of modeled habitat for riparian woodrat habitat. None of this habitat is considered occupied.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community

(CM3) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 9 conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

NEPA Effects: Alternative 9 would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The habitat that Alternative 9 would affect is currently unoccupied, and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals would not have an adverse effect on riparian woodrat.

CEQA Conclusion:

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant for CEQA purposes.

Alternative 9 would result in permanent and temporary effects on 3 acres of modeled habitat for riparian woodrat in the near-term as a result of construction of the water conveyance facilities (CM1). The habitat would be lost in the valley/foothill riparian. All the near-term loss of riparian woodrat habitat would result from CM1 conveyance facility construction in CZ 8, and would occur in an area not likely to be occupied by the species. Habitat loss in CZ 7, in areas known or likely to be occupied, would occur during the early long-term and late long-term implementation periods. Riparian restoration would be phased to minimize temporal habitat loss. There would be no near-term losses from CM2–CM18.

Typical CEQA project-level mitigation ratios for these natural communities that would be affected and that are identified in the biological goals and objectives for riparian woodrat in Chapter 3 of the BDCP would be 1:1 for restoration and 1:1 for protection of the valley/foothill riparian natural community. Using these ratios would indicate that 3 acres of riparian habitat should be restored and 3 acres of riparian habitat should be protected for riparian woodrat for near-term losses.

The BDCP has committed to near-term restoration of 800 acres of riparian (Objective VFRNC1.1) and protection of 750 acres of riparian (Objective VFRNC1.2) (Table 3-4 in Chapter 3, *Description of Alternatives*). In addition, the species-specific biological goals and objectives (RW1.1 and RW1.2) would inform the near-term protection and restoration efforts. The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. The Plan also contains commitments to implement AMM1–AMM7, AMM10, and AMM25, which contain elements that avoid or minimize the risk of affected habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA, because no riparian woodrat habitat would be lost and there is only limited potential for minor adverse effects on woodrats or its habitat from implementation of CM11.

Late Long-Term Timeframe

The study area supports approximately 2,166 acres of modeled riparian woodrat habitat. Alternative 9 as a whole would result in the permanent loss of and temporary removal of 87 acres of modeled habitat for riparian woodrat habitat. None of this habitat is considered occupied.

The BDCP would restore 5,000 acres and protect 750 acres of valley/foothill riparian natural community, a portion of which is expected to consist of suitable riparian brush rabbit habitat (Objectives VFRNC1.1 and VFRNC1.2). Objective RW1.1 requires at least 300 acres of riparian habitat that meets the ecological requirements of the riparian woodrat (e.g., dense willow understory and oak overstory) and that is adjacent to or facilitates connectivity with existing occupied or potentially occupied habitat to be restored in CZ 7. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian woodrat habitat. The species-specific objective further requires that the 300 acres of restored riparian habitat meet more specific ecological requirements of riparian woodrat (e.g., dense willow understory and oak overstory). Additionally, assuming the protected riparian natural community would provide riparian woodrat habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (12% of the riparian natural community in the Plan Area is modeled riparian woodrat habitat), the protection of 750 acres of riparian natural community (CM3) would provide an estimated 90 acres of protected riparian woodrat habitat that is comparable to or of higher value than existing modeled grassland habitat. All riparian protection would occur during the near-term period, to offset early riparian losses.

The BDCP would also create and maintain mounds, levee sections, or other high areas in restored and protected riparian areas (Objective RW1.2) that are designed specifically to provide flood refugia for the riparian woodrat (BDCP Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*). In addition, the restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more) (Objective L1.5): these infrequently flooded areas would provide refuge for the riparian woodrat during most years.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of valley/foothill riparian that could overlap with the species model, would result in the restoration of 300 acres of modeled habitat for riparian woodrat. In addition, protection of valley/foothill riparian could overlap with the species model and would result in the protection of 90 acres riparian woodrat modeled habitat.

Although there are no records of occurrences of the riparian woodrat in the study area, habitat restoration in CZ 7, in the vicinity of occurrences south of the study area, would increase opportunities for northward expansion of the species into the study area Implementation of Alternative 9 conservation measures is not expected to adversely affect the riparian woodrat for the following reasons.

- There are no riparian woodrat occurrences in the Plan Area.
- The habitat that would be removed consists of small patches that are of moderate value for the species.
- The habitat that would be removed permanently is a small proportion of the total habitat in the Plan Area (2%).
- Avoidance and minimization measures would be implemented to avoid injury or mortality of riparian woodrats, and to minimize loss of occupied habitat.
- Floodplain restoration would be designed to provide flood refugia so that flooding would not adversely affect any riparian woodrats that occupy restored floodplains.

Alternative 9 would provide a substantial benefit to the riparian woodrat through the net increase in available habitat and a net increase of habitat in protected status. These protected areas would be managed and monitored to support the species. The affected habitat is currently unoccupied and habitat removal is not expected to result in a discernible change in the abundance or distribution of riparian woodrats if they occupy study area habitats. Should the species be detected in the study area, implementation of AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the effects of conservation component construction and implementation. Therefore, the loss of habitat and potential mortality of individuals under Alternative 9 would not have a significant impact on riparian woodrat.

Impact BIO-156: Indirect Effects of Plan Implementation on Riparian Woodrat

Noise, lighting, and visual disturbance adjacent to construction activities could indirectly affect the use of modeled habitat for riparian woodrat. These effects are related construction activities associated with water conveyance construction, tidal natural communities restoration construction, and construction of setback levees. Indirect effects on the species from construction associated with tidal natural communities restoration are unlikely because tidal natural communities restoration projects would be sited to avoid areas occupied by riparian woodrat (AMM25). The activity most likely to result in noise, lighting, and visual disturbance to riparian woodrat would be the construction of setback levees. These adverse effects would be minimized through implementation of AMM1–AMM7, AMM10, and AMM25.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 9 would avoid the potential for substantial adverse effects on riparian woodrats, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Therefore, indirect effects of Alternative 9 would not have an adverse effect on riparian woodrat.

CEQA Conclusion: Should the species be detected in the study area, indirect effects of conservation measure construction and implementation could impact riparian woodrat and its habitat. AMM1–AMM7, AMM10, and AMM25 would avoid and minimize the impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Conservation Components

CM5 Seasonally inundated floodplain restoration is the only covered activity expected to result in periodic inundation of riparian woodrat habitat. Floodplain restoration would result in periodic inundation of up to 203 acres of riparian woodrat habitat (9% of the riparian woodrat habitat in the Plan Area). The area between existing levees that would be breached and the newly constructed setback levees would be inundated through seasonal flooding. The potentially inundated areas consist of moderate-value habitat for the species. Although the habitat consists of small patches and narrow bands of riparian vegetation and no riparian woodrats have detected in CZ 7, the riparian patches are in proximity to each other along the San Joaquin River and there are two species occurrences immediately south of CZ 7, one of which is less than 1 mile from the southernmost patch of riparian habitat potentially affected by levee construction. The restored floodplains would transition from areas that flood frequently (e.g., every 1 to 2 years) to areas that flood infrequently (e.g., every 10 years or more).

***NEPA Effects*:** Alternative 9's periodic inundation of 203 acres of riparian habitat is not expected to result in substantial adverse effects on riparian woodrat, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrat. The effects of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation. Therefore, the periodic inundation of riparian woodrat habitat would not adversely affect the species under Alternative 9.

CEQA Conclusion: Floodplain restoration under CM5 would periodically affect a total of 203 acres of riparian habitat for riparian woodrat, representing 9% of the 2,166 acres of modeled riparian woodrat habitat in the study area. The impact of periodic inundation on the riparian woodrat would be minimized through construction and maintenance of flood refugia to allow riparian woodrats to escape inundation, as described in AMM25. Implementation of CM5 would not be expected to result in significant impacts on riparian woodrat, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of riparian woodrats. Periodic inundation of riparian woodrat habitat under Alternative 9 would have a less-than-significant impact.

Salt Marsh Harvest Mouse

The habitat model used to assess effects for the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Construction and restoration associated with Alternative 9 conservation measures would result in effects to modeled salt marsh harvest mouse habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-9-57. All of the effects to the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit salt marsh harvest mouse (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary salt marsh harvest mouse habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (Objective TBEWNC2.1).
- Protect and enhance at least 1,500 acres of managed wetland in Grizzly Island Marsh Complex for the benefit of salt marsh harvest mouse (Objective MWNC1.1, associated with CM3).
- Protect or restore grasslands adjacent to restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area (Objective GNC1.4, associated with CM3 and CM8).

- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of restored or created middle and high marsh as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Objective SMHM1.1).
- Provide viable habitat areas for salt marsh harvest mouse within the 1,500 acres of managed wetland protected and enhanced in the Grizzly Island Marsh Complex as defined in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California, and increase population levels above the current baseline (Objective SMHM1.2).

As explained below, with the restoration or protection of these amounts of habitat, impacts on the salt marsh harvest mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-57. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	**0**	**0**	**0**		
CM2–CM18	TBEW Primary	64	67	0	0	0	0
	TBEW Secondary	0	0	0	0	0	0
	Upland Secondary	8	9	0	0	0	0
	MW Wetland Primary	1,913	5,323	0	0	0	0
	MW Wetland Secondary	315	807	0	0	0	0
	MW Upland	165	762	0	0	0	0
Total Impacts CM2–CM18		**2,465**	**6,968**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**2,645**	**6,968**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

TBEW = tidal brackish emergent wetland
MW = managed wetland
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

BDCP tidal restoration (CM4) would be the only conservation measure resulting in effects on salt marsh harvest mouse habitat. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects to 6,968 acres of salt marsh harvest mouse modeled habitat, which would include 5,376 acres of permanent losses and 1,592acres of habitat conversions. Salt marsh harvest mouse may be displaced temporarily from areas of converted habitat but these areas would ultimately provide suitable habitat for the species. However, 1,058 of these acres would be downgraded from primary habitat (67 acres of primary tidal brackish emergent wetland and 991 acres of primary managed wetland) to secondary tidal brackish emergent wetland. The hypothetical restoration footprints in Suisun Marsh overlap with 13 CNDDB records for salt marsh harvest mouse (California Department of Fish and Wildlife 2013); however, the BDCP's conservation actions assume that all suitable habitat in Suisun Marsh is occupied by the species.
- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 1,500 acres of tidal brackish emergent wetland would be managed to provide viable habitat for salt marsh harvest mouse and the protection of 1,500 acres of managed wetland specifically to be managed for salt marsh harvest mouse. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas for salt marsh harvest mouse and may result in localized ground disturbances that could temporarily remove small amounts of salt marsh harvest mouse habitat. The restoration of tidal brackish emergent wetlands, the protection of managed wetlands, and the protection and/or restoration of grasslands within 200 feet of restored salt marsh harvest mouse habitat would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of salt marsh harvest mouse habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to salt marsh harvest mouse during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. Alternative 9 would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be from primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 1,500 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects to salt marsh harvest mouse.

Other factors relevant to effects on salt marsh harvest mouse are listed here.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan. Restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs. This phasing would ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project-level impacts on salt marsh harvest mouse resulting from CM1, the analysis of the effects and conservation actions does not include a comparison with standard ratios used for project-level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 9 as a whole would result in effects to 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. These effects (loss and conversion) would be on 20% of the modeled habitat in the study area. Most of these effects (99%) would be to managed wetlands, which though are known to be occupied by salt marsh harvest mouse are at high risk of catastrophic flooding and have a lower long-term conservation value than tidal wetlands (U.S. Fish and Wildlife Service 2010). Effects on up to 20% of the species' habitat in the Plan Area may diminish the salt marsh harvest mouse population in the Plan Area and result in reduced genetic diversity, thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas.

The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4), the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).
- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

NEPA Effects: In the absence of other conservation actions, the effects on salt marsh harvest mouse habitat from Alternative 9 would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of salt marsh harvest mouse habitat and potential mortality of individuals in the near-term and late long-term under Alternative 9 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would be less than significant under CEQA. Alternative 9 would affect 2,465 acres of salt marsh harvest mouse modeled habitat in the study area in the near-term. These effects include 1,517 acres of permanent loss and 948 acres of converted habitat. Most of the habitat converted would be to primary habitats (599 acres consisting of 64 acres of tidal brackish emergent wetland and 534 acres of managed wetland) to secondary tidal brackish emergent wetland.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland, the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, and the protection and enhancement of 3,200 acres of managed wetlands for salt marsh harvest mouse. Though there would be a net loss of modeled habitat, nearly all of these losses (97%) are to managed wetlands, which according to the U.S. Fish and Wildlife Service are at high risk of catastrophic flooding (U.S. Fish and Wildlife Service 2010) and have lower long-term conservation value than tidal wetlands. The species-specific biological goals and objectives would inform the near-term protection and restoration efforts. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of protection and restoration contained in the near-term Plan goals would keep pace with the loss of habitat and effects to salt marsh harvest mouse habitat.

Other factors relevant to effects on salt marsh harvest mouse are listed here.

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the specie's draft recovery plan because the conversion of managed wetland to tidal marsh occurs be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service 2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP would be consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- To ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).
- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

Because there would be no project level impacts on salt marsh harvest mouse resulting from CM1, the analysis of the effects and conservation actions does not include a comparison with standard ratios used for project level CEQA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan*, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 35,588 acres of salt marsh harvest mouse modeled habitat. Alternative 9 as a whole would result in effects to 6,968 acres of saltmarsh harvest mouse modeled habitat over the term of the Plan, which would include 5,376 acres of permanent losses and 1,592 acres of habitat conversions. The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for salt marsh harvest mouse) (TBEWNC1.1, TBEWNC1.2, SMHM1.1, associate with CM4); the protection of 6,500 acres of managed wetlands, 1,500 acres of which would be specifically managed for salt marsh harvest mouse (SMHM1.2 and MWNC1.1, associated with CM3), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration) to provide upland refugia for salt marsh harvest mouse (GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on salt marsh harvest mouse include:

- Tidal restoration actions would not immediately displace salt marsh harvest mouse in managed wetlands as noted in the draft recovery plan for salt marsh harvest mouse because the conversion of managed wetland to tidal marsh would be gradual. Tidal marsh restoration is often accomplished by breaching levees and converting diked nontidal marsh currently occupied by salt marsh harvest mouse populations to tidal wetlands, their historic condition. Conversion of these subsided areas requires sedimentation and accretion over time to restore marsh plains, resulting in a prolonged period (sometimes a decade or more) in which resident mice populations are displaced by uninhabitable aquatic areas (U.S. Fish and Wildlife Service

2010). Despite these temporary adverse effects, the draft recovery plan and Suisun Marsh Plan advocate strongly for restoration of tidal wetlands through the conversion of managed wetlands. These plans are based on the premise that managed wetlands are at high risk of loss of salt marsh harvest mouse habitat from a variety of factors, including flooding from levee failure and cessation of active management (which is often necessary to maintain habitat values in managed wetlands). Therefore, the temporary effects under BDCP are consistent with those deemed acceptable in the draft recovery plan for salt marsh harvest mouse and the Suisun Marsh Plan.

- In order to ensure that temporal loss as a result of tidal natural communities restoration does not adversely affect the salt marsh harvest mouse population, restoration in Suisun Marsh would be carefully phased over time to offset adverse effects of restoration as it occurs, ensure that short-term population loss is relatively small and incremental, and maintain local source populations to recolonize newly restored areas. The tidal restoration projects in Suisun Marsh would be implemented in 150-acre or greater patches that provide viable habitat areas for the salt marsh harvest mouse habitat consistent with the draft tidal marsh recovery plan (U.S. Fish and Wildlife Service 2010).

- The salt marsh harvest mouse population would be monitored during the phasing process (see BDCP Chapter 3, Section 3.4.4.3.4,), and adaptive management would be applied to ensure maintenance of the population as described in the BDCP (BDCP Chapter 3, Section 3.4.4.4 and Section 3.6).

- The BDCP commits to manage reserve areas so that perennial pepperweed cover is no more than 10% in tidal brackish emergent wetlands (Objective TBEWNC2.1), which would benefit pickleweed production in the marsh. Salt marsh harvest mouse depends on pickleweed for forage and cover.

- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value, which is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,046 acres and the protection of 1,550 acres of modeled habitat for salt marsh harvest mouse.

Alternative 9 would result in substantial modifications to salt marsh harvest mouse habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8 and CM11, guided by species-specific goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period, Alternative 9 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on salt marsh harvest mouse.

Impact BIO-159: Indirect Effects of Plan Implementation on Salt Marsh Harvest Mouse

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to salt marsh harvest mouse occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on salt marsh harvest mouse.

Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High tidal marsh is considered to be primary habitat for salt marsh harvest mouse and thus the species could be exposed to methyl mercury in tidal restoration areas. Salt marsh harvest mouse may be exposed to elemental mercury by feeding on pickleweed, which is found concentrated in the distal tips of pickleweed leaves (Yee et. al., 2008). Though elemental mercury is less bioavailable than methylmercury, studies have shown that mercury can become methylated in the anaerobic portions of the intestinal tract (Rudd et al. 1980, Rieder et al. 2013) and could thus become a pathway for salt marsh harvest exposure to methylmercury. A study of small mammals residing in pickleweed around the San Francisco Bay showed an absence of salt marsh harvest mouse where mercury concentrations measured in house mice (*Mus musculus*) livers were ≥0.19 µg/g (dry weight) (Clark et al. 1992). Clark et al (1992) also report that the lack of salt marsh harvest mouse at these locations are not the result of undetected habitat differences or are by chance. Clarke et al (1992) suggest that the absence of salt marsh harvest mouse at certain locations may be associated with higher amounts of mercury and polychlorinated biphenyls (PCBs); however, because their study didn’t analyze contaminants in salt marsh harvest mouse and because (at that time) there was no data in the literature on contaminants in harvest mice, they could not make conclusions on these associations. Currently, it is unknown what the exact exposure pathways are or what tissue concentrations are harmful to the salt marsh harvest mouse.

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for salt marsh harvest mouse exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on salt marsh harvest mouse resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 9 would avoid and minimize indirect effects on salt marsh harvest mouse. These AMMs would also avoid and minimize effects that could substantially reduce the number of salt marsh harvest mouse, or restrict the species’ range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on salt marsh harvest mouse.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact salt marsh harvest mouse within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact salt marsh harvest mouse and its habitat. The inadvertent discharge of sediment adjacent to salt marsh harvest mouse habitat could also impact the species. With implementation of AMM1–AMM5 and AMM26 as part of Alternative 9 construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on salt marsh harvest mouse, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse. The indirect effects of Alternative 9 would have a less-than-significant impact on salt marsh harvest mouse.

Salt marsh harvest mouse could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of salt marsh harvest mouse, and, therefore, would have a less-than-significant impact on the species.

Suisun Shrew

Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model. Construction and restoration associated with Alternative 9 conservation measures would result in effects to modeled Suisun shrew habitat, which would include permanent losses and habitat conversions (i.e., existing habitat converted to greater or lesser valued habitat for the species post-restoration) as indicated in Table 12-9-58. All of the effects on the species would take place over an extended period of time as tidal marsh is restored in the Plan Area. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP to benefit Suisun shrew (BDCP Chapter 3, *Conservation Strategy*).

- Restore or create 6,000 acres of tidal brackish emergent wetland in CZ 11 to be consistent with the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.1, associated with CM4)
- Within the 6,000 acres of tidal brackish emergent wetland restored or created, distribute 1,500 acres of middle and high marsh (primary Suisun shrew habitat) to contribute to total (existing and restored) acreage targets for each complex as specified in the final Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (TBEWNC1.2, associated with CM4).
- Limit perennial pepperweed to no more than 10% cover in the tidal brackish emergent wetland natural community within the reserve system (TBEWNC2.1).
- Protect or restore grasslands adjacent t restored tidal brackish emergent wetlands to provide at least 200 feet of adjacent grasslands beyond the sea level rise accommodation area, which provides refugia during high tides (GNC1.4, associated with CM3 and CM8).

As explained below, with the restoration or protection of these amounts of habitat, impacts on the Suisun shrew would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-58. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	(CM1 Outside of species range)	0	0	0	0	NA	NA
Total Impacts CM1		**0**	0	**0**	**0**		
CM2–CM18	Primary	58	60	0	0	0	0
	Secondary	47	342	0	0	0	0
Total Impacts CM2–CM18		**105**	**401**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**105**	**401**	**0**	**0**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun shrew

BDCP tidal restoration (CM4) would be the only conservation measure resulting in loss of habitat to Suisun shrew. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these activities is described in detail below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM4 Tidal Natural Communities Restoration* would result in effects to 401 acres of Suisun shrew modeled habitat, which would include 377 acres of permanent losses and 24 acres of habitat conversions. Suisun shrew may be displaced temporarily from areas of converted habitat but would ultimately provide suitable habitat for the species. However, all 24 acres would be converted from secondary to primary habitat and therefore over would be a net benefit to the species. The hypothetical restoration footprints overlap with two CNDDB records for Suisun shrew (California Department of Fish and Wildlife 2013).

- *CM11 Natural Communities Enhancement and Management:* As described in the BDCP, the restoration of at least 6,000 acres of tidal brackish emergent wetland would be managed to provide habitat for covered species, including Suisun shrew. A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance and manage these areas may result in localized ground disturbances that could temporarily remove small amounts of Suisun shrew habitat. The areas of grasslands that would be protected and/or restored within 200 feet of restored tidal marsh would also have enhancement and management actions that would include invasive species control, nonnative wildlife control, and vegetation management. Ground-disturbing activities, such as removal of

nonnative vegetation are expected to have minor effects on habitat and are expected to result in overall improvements to and maintenance of Suisun shrew habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Injury and Direct Mortality: The use of heavy equipment and handtools may result in injury or mortality to Suisun shrew during restoration, enhancement, and management activities. However, preconstruction surveys, construction monitoring, and other measures would be implemented to avoid and minimize injury or mortality of this species during these activities, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would not be adverse under NEPA. Alternative 9 would affect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects to Suisun shrew.

Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there would be no project level impacts on Suisun shrew from CM1, the analysis of the effects and conservation actions does not include a comparison to standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, and *AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 9 as a whole would result in effects on 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area).

The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, SMHM1.1, associated with CM4) and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet would likely benefit the species) to provide upland refugia for Suisun shrew (Objectives GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.

The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres). The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

NEPA Effects: In the absence of other conservation actions, the effects on Suisun shrew habitat from Alternative 9 would represent an adverse effect as a result of habitat modification and potential for direct mortality of a special-status species. However, the BDCP has committed to habitat protection, restoration, management, and enhancement with CM3, CM4, CM8, and CM11. This habitat protection, restoration, management, and enhancement would be guided by biological goals and objectives and by AMM1–AMM5 and AMM26, which would be in place throughout the construction period. Considering these commitments, losses and conversions of Suisun shrew habitat and potential mortality of individuals in the near-term and late long-term under Alternative 9 would not be an adverse effect.

CEQA Conclusion:

Near-Term Timeframe

The near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection and/or restoration in an appropriate timeframe to ensure that the effects of near-term covered activities would be less than significant under CEQA. Alternative 9 would affect 105 acres of Suisun shrew modeled habitat in the study area in the near-term. These effects include 90 acres of permanent loss and 15 acres of converted habitat, which is all secondary habitat being converted to primary habitat.

The BDCP has committed to near-term goals of restoring 2,000 acres of tidal brackish emergent wetland and the protection and/or restoration of grasslands within 200 feet of restored tidal wetlands, of which approximately 150 feet of this area would benefit the species. These Plan goals represent performance standards for considering the effectiveness of restoration actions. The acres of tidal restoration and the commitment to protection of adjacent uplands contained in the near-term Plan goals would keep pace with the loss of habitat and effects to Suisun shrew.

Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored in the near term (2,000 acres) greatly exceeds the amount permanently lost (105 acres).

Because there are no project level impacts on Suisun shrew from CM1, the analysis of the effects and conservation actions does not include a comparison with standard ratios used for project level NEPA analyses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, and AMM26 Salt Marsh Harvest Mouse and Suisun Shrew*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

Based on modeled habitat, the study area supports approximately 7,515 acres of Suisun shrew modeled habitat. Alternative 9 as a whole would result in effects to 401 acres of Suisun shrew modeled habitat over the term of the Plan, which would include 377 acres of permanent losses and 24 acres of habitat conversions (roughly 5% of the habitat in the study area). The Plan includes a commitment to restore or create 6,000 acres of tidal brackish emergent wetland, 1,500 acres of which would target middle and high marsh habitat (primary habitat for Suisun shrew) (Objectives TBEWNC1.1, TBEWNC1.2, and SMHM1.1, associated with CM4), and the protection and/or restoration of grassland adjacent to tidal restoration (areas within 200 feet of tidal restoration, of which approximately 150 feet of this area would benefit the species) to provide upland refugia for

Suisun shrew (Objective GNC1.4, associated with CM3 and CM8). Other factors relevant to effects on Suisun shrew are listed below.

- Restoration would be sequenced and oriented in a manner that minimizes any temporary, initial loss of habitat and habitat fragmentation.
- The habitat that would be restored and protected would consist of large blocks of contiguous tidal brackish emergent wetland that has a large proportion of pickleweed-dominated vegetation suitable for the species. This would provide greater habitat connectivity and greater habitat value and quantity, with is expected to accommodate larger populations and to therefore increase population resilience to random environmental events and climate change.
- The amount of tidal habitat restored (6,000 acres) greatly exceeds the amount permanently lost and converted (401 acres).

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above could result in the restoration of 6,006 acres and the protection of 232 acres of modeled habitat for Suisun shrew.

Alternative 9 would result in substantial modifications to Suisun shrew habitat in the absence of other conservation actions. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM4, CM8, and CM11, guided by species-specific goals and objectives and by AMM1–AMM5, and AMM26, which would be in place throughout the construction period, Alternative 9 over the term of the BDCP would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on Suisun shrew.

Impact BIO-161: Indirect Effects of Plan Implementation on Suisun Shrew

Construction/disturbance activities associated tidal restoration (CM4), grassland restoration (CM8), and management and enhancement activities (CM11) could result in temporary noise and visual disturbances to Suisun shrew occurring within 100 feet of these areas over the term of the BDCP. These potential effects would be minimized or avoided through AMM1–AMM5, and AMM26, which would be in effect throughout the term of the Plan.

The use of mechanical equipment during the implementation of the conservation measures could cause the accidental release of petroleum or other contaminants that could affect Suisun shrew and its habitat. The inadvertent discharge of sediment could also have a negative effect on the species and its habitat. AMM1–AMM5 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment on Suisun shrew.

Tidal marsh restoration has the potential to increase Suisun shrew's exposure to mercury. Mercury is transformed into the more bioavailable form of methylmercury under anaerobic conditions, which in the environment typically occurs in sediments subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). High and mid tidal marsh is considered to be primary habitat for Suisun shrew and thus the species could be exposed to methylmercury in tidal restoration areas. Suisun shrew could be exposed to methylmercury by feeding on marsh invertebrates that may bioaccumulate methylmercury from marsh sediments. Toxic concentrations of methylmercury have been found in the kidneys of shrews that inhabit contaminated sites and forage on earthworms and other prey that live within contaminated sediments (Talmage and Walton 1993; Hinton and Veiga 2002).

The Suisun Marsh Plan (Bureau of Reclamation et al. 2010) anticipates that tidal wetlands restored under the plan would generate less methylmercury than the existing managed wetlands. The potential for Suisun shrew exposure to methyl mercury in Suisun Marsh may decrease in the long term because the creation of tidal brackish emergent wetland would predominantly result from the conversion of managed wetlands. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, CM12 could reduce the effects of methylmercury on Suisun shrew resulting from BDCP tidal restoration.

NEPA Effects: Implementation of the AMMs listed above as part of implementing Alternative 9 would avoid and minimize the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of Suisun shrew, or restrict the species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on Suisun shrew.

CEQA Conclusion: Indirect effects from construction-related noise and visual disturbances could impact Suisun shrew within 100 feet of these disturbances. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact Suisun shrew and its habitat. The inadvertent discharge of sediment adjacent to Suisun shrew habitat could also impact the species. With implementation of AMM1–AMM5, and AMM26 as part of Alternative 9 construction, operation and maintenance, the BDCP would avoid the potential for substantial adverse effects on Suisun shrew, either indirectly or through habitat modifications, in that the BDCP would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew. The indirect effects of Alternative 9 would have a less-than-significant impact on Suisun shrew.

Suisun shrew could experience indirect effects from increased exposure to methylmercury as a result of tidal habitat restoration (CM4). With implementation of CM12, the potential indirect effects of methlymercury would not result in a substantial reduction in numbers or a restriction in the range of Suisun shrew, and, therefore, would have a less-than-significant impact on the species.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10. The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013) reports eight occurrences of San Joaquin kit foxes along the extreme western edge of the Plan Area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-9-59). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin kit fox habitat and potential American badger habitat. Full implementation of Alternative 9 would also include biological objectives over the term of the BDCP to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the Plan Area; and providing connectivity to habitat outside the Plan Area. The conservation measures that would be implemented to achieve the biological goals and objectives are summarized below.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the Plan Area (Objective L3.1, associated with CM3-8, and CM11).
- Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
- Restore or create alkali seasonal wetlands in CZ 1, CZ 8, and/or CZ 11 (up to 72 acres of alkali seasonal wetland complex restoration) (Objective ASWNC1.2, associated with CM3 and CM9).
- Protect 600 acres of existing vernal pool complex in CZ 1, CZ 8, and/or CZ 11, primarily in core vernal pool recovery areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) (Objective VPNC1.1, associated with CM3).
- Restore vernal pool complex in CZ 1, CZ 8, and/or CZ 11 to achieve no net loss of vernal pool acreage (up to 67 acres of vernal pool complex restoration) (Objective VPNC1.2, associated with CM3 and CM9).
- Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grassland (Objective GNC1.2, associated with CM3 and CM8).
- Increase burrow availability for burrow-dependent species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.3, associated with CM11).
- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding alkali seasonal wetlands within restored and protected alkali seasonal wetland complex (Objective ASWNC2.4, associated with CM11).
- Increase burrow availability for burrow-dependent species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.4, associated with CM11).

- Increase prey, especially small mammals and insects, for grassland-foraging species in grasslands surrounding vernal pools within restored and protected vernal pool complex (Objective VPNC2.5, associated with CM11).
- Increase burrow availability for burrow-dependent species (Objective GNC2.3, associated with CM11).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species (Objective GNC2.4, associated with CM11).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-59. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent		Temporary		Periodic[d]	
		NT	LLT[c]	NT	LLT[c]	CM2	CM5
CM1	Grassland	15	15	10	10	NA	NA
Total Impacts CM1		**15**	**15**	**10**	**10**		
CM2–CM18	Grassland	3	8	0	0	0	0
Total Impacts CM2–CM18		**3**	**8**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**18**	**23**	**10**	**10**	**0**	**0**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 9 conservation measures would result in the permanent and temporary loss combined of 33 acres of modeled habitat for the San Joaquin kit fox (Table 12-9-59). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects on are anticipated to be the same as those described for San Joaquin kit fox. There are no San Joaquin kit fox and no American badger occurrences that overlap with the Plan footprint. Construction of Alternative 9 water conveyance facilities (CM1) and recreation facilities (CM11) would remove habitat. Habitat enhancement and management activities (CM11) could result in local adverse effects on species. In addition, construction vehicle activity could cause injury or mortality of San Joaquin kit foxes and badgers. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 15 acres and the temporary loss of 10 acres of modeled San Joaquin kit fox habitat and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8.

- *CM11 Natural Communities Enhancement and Managemen*t: The creation of recreational trails and recreational staging areas would result in the permanent removal of 8 acres of San Joaquin kit fox modeled habitat and American badger potential habitat. *AMM24 San Joaquin Kit Fox,* would be implemented to ensure that San Joaquin kit fox dens are avoided, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Mitigation Measure BIO-162*: Conduct Preconstruction Survey for American Badger* would be implemented to ensure that American badger dens are avoided.

  Passive recreation in the reserve system could result in disturbance of San Joaquin kit foxes and American badgers at their den site. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox and American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox or American badger populations. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

  The BDCP would require the protection of grasslands in large patch sizes connected to existing large areas of grassland, habitat corridors and transition habitat areas to improve the ecological functions of the grasslands necessary to support the San Joaquin kit fox. American badger is expected to benefit in a similar fashion.

  The BDCP would require the enhancement and management of these protected existing grasslands and restored grasslands to improve their function as a natural community of plants and wildlife and for associated covered species, including San Joaquin kit fox and American badger. The BDCP also includes actions to improve rodent prey availability.

  However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. A variety of habitat management actions included in *CM11* that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values over the term of the BDCP. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs and mitigation measures listed below. These AMMs and mitigation measures would remain in effect throughout the BDCP's construction phase.

- Operations and maintenance: Ongoing maintenance of BDCP facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, and AMM24 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA.

Under Alternative 9 there would be a loss of 28 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (25 acres) and CM11 (3 acres).

Typical NEPA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 56 acres of grassland should be protected for San Joaquin kit fox to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for NEPA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of

Alternative 9 would be not be adverse under NEPA, because the number of acres required to meet the typical ratios described above would be only 56 acres of grassland protected.

The effects on San Joaquin kit fox and American badger habitat from Alternative 9 as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other conservation actions. However, the effects of Alternative 9 would be not be adverse with habitat protection, restoration, and management and enhancement in addition to implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 9 as a whole would result in the permanent loss of and temporary effects to 33 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing less than 1% of the modeled habitat.

With full implementation of the BDCP, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger is most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for both species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1)and to other adjoining San Joaquin kit fox habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the

San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

***NEPA Effects*:** In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 9 would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in effect during the construction period, and with implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*, the effects of Alternative 9 as a whole on San Joaquin kit fox and American badger would not be adverse under NEPA.

***CEQA Conclusion*:**

Near-Term Timeframe

Because water conveyance facilities construction (CM1) is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction impacts would be less than significant under CEQA.

Under Alternative 9 there would be a loss of 28 acres of San Joaquin kit fox modeled habitat and American badger habitat from CM1 (25 acres) and CM11 (3 acres).

Typical CEQA project-level mitigation ratio for the natural community that would be affected and that is identified in the biological goals and objectives for San Joaquin kit fox in Chapter 3 of the BDCP would be 2:1 for protection of grassland. Using this ratio would indicate that 56 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

The BDCP has committed to near-term restoration of 58 acres of alkali seasonal wetland (Objective ASWNC1.2), 40 acres of vernal pool complex (Objective VPNC1.2), and 1,140 acres of grassland (Objective GNC1.2). In addition, there would be near-term protection of 120 acres of alkali seasonal wetland (Objective ASWNC1.1), 400 acres of vernal pool complex (Objective VPNC1.1), and 2,000 acres of grassland (Objective GNC1.1). The natural community restoration and protection activities are expected to be concluded during the first 10 years of Plan implementation, which is close enough in time to the occurrence of impacts to constitute adequate mitigation for CEQA purposes. These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would not be significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 56 acres of grassland protected.

The BDCP also contains commitments to implement AMM1–AMM6, AMM10, AMM24, and AMM37 which include elements that avoid or minimize the risk of construction activity impacting habitat and species adjacent to work areas and storage sites. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 on San Joaquin kit fox and American badger would be less than significant under CEQA, because the number of acres required to meet the typical ratios described above would be only 56 acres of grassland protected

Late Long-Term Timeframe

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 9 as a whole would result in the permanent loss of and temporary effects to 33 acres of modeled habitat for San Joaquin kit fox and potential habitat for American badger representing less than 1% of the modeled habitat.

With full implementation of the BDCP, at least 1,000 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger are most likely to occur if present in the Plan Area. Additionally, a portion of the 2,000 acres of grassland restoration would likely occur in CZ 8. Assuming the restored grasslands would provide suitable San Joaquin kit fox habitat proportional to the amount of modeled habitat in this natural community in the Plan Area (6.8% of the grasslands in the Plan Area consist of modeled San Joaquin kit fox habitat), an estimated 132 acres of restored grasslands would be suitable for the species (6.6% of 2,000 acres).

Because San Joaquin kit fox home ranges are large (ranging from around 1 to 12 square miles; see BDCP Appendix 2.A, *Covered Species Accounts*), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 (Objective L3.1)and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the Plan Area. Connectivity to occupied habitat adjacent to the Plan Area would help ensure the movement of San Joaquin kit foxes and American badgers, if present, to larger habitat patches outside of the Plan Area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (BDCP Appendix 2.A). This area connects to over 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range (Objectives ASWNC2.3, ASWNC2.4, VPNC2.4, Objective VPNC2.5, Objective GNC2.3, Objective GNC2.4). These management and enhancement actions are expected to benefit the

San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected and restoration grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The BDCP's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

The BDCP's beneficial effects analysis (BDCP Chapter 5, Section 5.6, *Effects on Covered Wildlife and Plant Species*) estimates that the restoration and protection actions discussed above, as well as the restoration of grassland and vernal pool that could overlap with the species model, would result in the restoration of 131 acres of modeled habitat for San Joaquin kit fox. In addition, protection of grassland and vernal pool complex could overlap with the species model and would result in the protection of 1,011 acres of modeled habitat for San Joaquin kit fox. These restoration and protection actions would also benefit the American badger.

In the absence of other conservation actions, the effects on San Joaquin kit fox and American badger habitat from Alternative 9 would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement associated with CM3, CM8, and CM11, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 9 as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project-related conservation areas within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Plan Implementation on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facility, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, if any, and other measures as described in AMM24 and Mitigation Measure BIO-162.

***NEPA Effects*:** Implementation of the AMMs listed above and Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger,* would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on San Joaquin kit fox or American badger.

CEQA Conclusion: Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 9 construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. In addition, Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger,* would reduce the impact of indirect effects of Alternative 9 on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

Habitat for this species consists of the grassland natural community throughout the Plan Area. The species requires friable soils for burrowing. Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-9-60. Full implementation of Alternative 9 would also include the following conservation actions over the term of the BDCP that would likely benefit San Joaquin pocket mouse.

- Protect 8,000 acres of grasslands (GNC1.1, associated with CM3).
- Restore 2,000 acres of grasslands to connect fragmented patches of protected grasslands (GNC1.2, associated with CM8).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (GNC2.1).

As explained below, with the restoration or protection of these amounts of habitat, impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-60. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 9 (acres)[a]

Conservation Measure[b]	Habitat Type	Permanent NT	Permanent LLT[c]	Temporary NT	Temporary LLT[c]	Periodic[d] CM2	Periodic[d] CM5
CM1	Grassland	82	82	344	344	NA	NA
Total Impacts CM1		**82**	**82**	**344**	**344**		
CM2–CM18	Grassland	889	2,057	239	273	385–1,277	514
Total Impacts CM2–CM18		**889**	**2,057**	**239**	**273**	**385–1,277**	**514**
TOTAL IMPACTS		**971**	**2,139**	**583**	**617**	**385–1,277**	**514**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.
[b] See discussion below for a description of applicable CMs.
[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.
[d] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as a range based on different flow regimes at the proposed notch in Fremont Weir.
NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 9 conservation measures would result in the combined permanent and temporary loss of up to 2,756 acres of habitat for San Joaquin pocket mouse (of which 2,139 acres would be a permanent loss and 617 acres would be a temporary loss of habitat, Table 12-9-60). Conservation measures that would result in these losses are conveyance facilities and transmission line construction, and establishment and use of borrow and spoil areas (CM1), *CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*. The majority of habitat loss would result from CM4. Habitat enhancement and management activities (CM11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation:* Construction of Alternative 9 conveyance facilities would result in the combined permanent and temporary loss of up to 426 acres of potential San

Joaquin pocket mouse habitat (82 acres of permanent loss, 344 acres of temporary loss) in CZ 5, CZ 6, and CZ 8. The majority of grassland that would be removed would on the existing levees along the conveyance route. These areas represent poor-value habitat for the species because most of these areas consists of narrow strips of grass that are often managed to remove burrowing species.

- *CM2 Yolo Bypass Fisheries Enhancement:* Construction of the Yolo bypass fisheries enhancement (CM2) would permanently remove 388 acres of potential San Joaquin pocket mouse habitat in the Yolo Bypass in CZ 2. In addition, 239 acres would be temporarily removed. Most of the grassland losses would occur at the north end of the bypass below Fremont Weir, along the Toe Drain/Tule Canal, and along the west side channels.
- *CM4 Tidal Natural Communities Restoration:* Tidal habitat restoration (CM4) site preparation and inundation would permanently remove an estimated 1,122acres of potential San Joaquin pocket mouse habitat. The majority of the losses would likely occur in the vicinity of Cache Slough, on Decker Island in the West Delta ROA, on the upslope fringes of Suisun Marsh, and along narrow bands adjacent to waterways in the South Delta ROA. Tidal restoration would directly impact and fragment remaining grassland just north of Rio Vista in and around French and Prospect Islands, and in an area south of Rio Vista around Threemile Slough.
- *CM5 Seasonally Inundated Floodplain Restoration:* Construction of setback levees to restore seasonally inundated floodplain (CM5) would permanently and temporarily remove approximately 85 acres of San Joaquin pocket mouse habitat (51 permanent, 34 temporary). These losses would be expected to occur along the San Joaquin River and other major waterways in CZ 7.
- *CM7 Riparian Natural Community Restoration*: Riparian restoration would impact 410 acres of grasslands, primarily in CZ 7, as part of tidal natural communities restoration (11 acres) and seasonal floodplain restoration (399 acres).
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Up to 10 acres of grassland would be permanently converted to vernal pool complex. The vernal pool and alkali seasonal wetland restoration would leave intact the grasslands surrounding the vernal pools. Temporary construction-related disturbance of grassland habitat would result from implementation of *CM9* in CZ 1, CZ 8, and CZ 11. However, all areas would be restored to their original or higher value habitat after the construction periods.
- *CM11 Natural Communities Enhancement and Management:* The creation of recreational trails and recreational staging areas would result in the permanent removal of 50 acres of grassland. The protection of 8,000 acres of grassland for covered species is also expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance to or direct mortality of San Joaquin pocket mouse if the species is present near work areas.

A variety of habitat management actions included in *CM11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values over the term of the BDCP. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. With full implementation of the BDCP, enhancement and management actions designed for western burrowing owl would also be expected to benefit these species. San Joaquin pocket mouse would benefit particularly from protection of grassland habitat against potential loss or degradation that otherwise could occur with future changes in existing land use.

- *CM18 Conservation Hatcheries:* Implementation of CM18 would remove up to 35 acres of San Joaquin pocket mouse habitat.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and conservation actions as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA. Alternative 9 would remove 1,554 acres of San Joaquin pocket mouse habitat (971 permanent, 583 temporary) in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 426 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*—1,128 acres).

Typical NEPA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 852 acres of grassland natural communities should be protected to mitigate the CM1 losses of 426 acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of San Joaquin pocket mouse habitat using the same typical NEPA and CEQA ratios (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under *CM11 Natural Communities*

Enhancement and Management, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 9 as a whole would result in the permanent loss of and temporary effects to 2,756 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create 2,000 acres of grassland in CZ 1, 8 and 11 (Objective GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, 2, 4, 5, 7, 8, and 11 in the study area) (Objective GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (Objective GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

NEPA Effects: In the near-term, the loss of San Joaquin pocket mouse habitat and potential for direct mortality would not be adverse because the BDCP has committed to protecting and restoring an acreage that would meet the typical mitigation ratios described above. In the absence of other conservation actions, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 9 would represent an adverse effect in the late long-term. However, the BDCP has committed to habitat protection and restoration associated with CM3, CM8, and CM11. This habitat protection and restoration would be guided by biological goals and objectives and by AMM1–AMM6 and AMM10, which would be in place throughout the construction period. Considering these commitments, losses of San Joaquin pocket mouse habitat and potential mortality under Alternative 9 would not be an adverse effect.

***CEQA Conclusion*:**

Near-Term Timeframe

Because the water conveyance facilities construction is being evaluated at the project level, the near-term BDCP conservation strategy has been evaluated to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the impacts of construction would be less than significant. Alternative 9 would remove 1,554 acres of modeled (971 permanent, 583 temporary) habitat for San Joaquin pocket mouse in the study area in the near-term. These effects would result from the construction of the water conveyance facilities (CM1, 426 acres), and implementing other conservation measures (*CM2 Yolo Bypass Fisheries Enhancement*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM7 Riparian Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM11 Natural Communities Enhancement and Management*, and *CM18 Conservation Hatcheries*—1,128 acres).

The typical CEQA project-level mitigation ratios for those natural communities affected by CM1 would be 2:1 protection of grassland habitat. Using this ratio would indicate that 852 acres of grassland natural communities should be protected to mitigate the CM1 losses of 426 acres of San Joaquin pocket mouse habitat. The near-term effects of other conservation actions would remove 1,128 acres of modeled habitat, and therefore require 2,256 acres of protection of San Joaquin pocket mouse habitat using the same typical NEPA and CEQA ratio (2:1 for protection).

The BDCP has committed to near-term goals of protecting 2,000 acres and restoring 1,140 acres of grassland natural community in CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11. The protection and restoration of grasslands, would result in a contiguous matrix of grassland, alkali seasonal wetland, and vernal pool natural communities which would expand habitat for San Joaquin pocket mouse and reduce the effects of current levels of habitat fragmentation. Under CM11 Natural Communities Enhancement and Management, San Joaquin pocket mouse would likely benefit from the management of the grasslands for general wildlife benefit.

These natural community biological goals and objectives would inform the near-term protection and restoration efforts and represent performance standards for considering the effectiveness of restoration actions for the species. The acres of protection and restoration contained in the near-term Plan goals would satisfy the typical mitigation ratios that would be applied to the project-level effects of CM1.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

These commitments are more than sufficient to support the conclusion that the near-term effects of Alternative 9 would be less than significant under CEQA.

Late Long-Term Timeframe

Based on the habitat model, the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 9 as a whole would result in the permanent loss of and temporary impacts on 2,756 acres of grasslands that could be suitable for San Joaquin pocket mouse (4% of the habitat in the study area). The locations of these losses are described above in the analyses of individual conservation measures. The Plan includes a commitment to restore or create 2,000 acres of grassland in CZ 1, 8 and 11 (Objective GNC1.2) and to protect 8,000 acres of grassland (with at least 2,000 acres protected in CZ 1, at least 1,000 acres in CZ 8, at least 2,000 acres protected in CZ 11, and the remainder distributed throughout CZ 1, 2, 4, 5, 7, 8, and 11 in the study area) (Objective GNC1.1). The Plan's commitment to restore grasslands such that they connect fragmented patches of already protected grasslands (Objective GNC1.2) would improve habitat connectivity and dispersal abilities of San Joaquin pocket mouse within and outside of the plan area. All protected habitat would be managed under *CM11 Natural Communities Enhancement and Management*.

Considering these protection and restoration provisions, which would provide acreages of new high-value or enhanced habitat in amounts suitable to compensate for habitats lost to construction and restoration activities, and with implementation of AMM1–AMM6 and AMM10, the loss of habitat or direct mortality through implementation of Alternative 9 would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Impact BIO-165: Indirect Effects of Plan Implementation on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat over the term of the BDCP. These potential effects would be minimized and avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the plan's construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

***NEPA Effects*:** Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on San Joaquin pocket mouse.

***CEQA Conclusion*:** Indirect effects from conservation measure operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6 and AMM10, as part of Alternative 9 construction, operation, and maintenance, the BDCP would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (Table 12A-2 in Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report* for details on methods and results).

The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat. At the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Construction and restoration associated with Alternative 9 conservation measures would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-4-61. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. The conservation measures that would be implemented to achieve the biological goals and objectives that would also benefit special-status bats are summarized below.

- Protect or restore 142,200 acres of high-value natural communities (Objective L1.1, associated with CM3). This objective includes protecting and restoring a variety of habitat types described below (BDCP Chapter 3, Table 3.3-4).
    - Protect 150 acres of alkali seasonal wetland in CZ 1, CZ 8, and/or CZ 11 among a mosaic of protected grasslands and vernal pool complex (Objective ASWNC1.1, associated with CM3).
    - Protect 600 acres of existing vernal pool complex (Objective VPNC1.1, associated with CM3).
    - Protect 8,000 acres of grassland (Objective GNC1.1, associated with CM3).
    - Protect 8,100 acres of managed wetland (Objective MWNC1.1, associated with CM3 and CM11).
    - Protect 48,625 acres of cultivated lands (Objective CLNC1.1, associated with CM3 and CM11).
    - Protect, restore, or create 2,740 acres of rice land or equivalent habitat type for the giant garter snake (Objective GGS3.1, associated with CM3, CM4, and CM10).
    - Restore 2,000 acres of grasslands to connect fragmented patches of protected (Objective GNC1.2, associated with CM3 and 8).
    - Restore 67 acres of vernal pool complex (Objective VPNC1.2, associated with CM3 and 9).
    - Restore and protect 65,000 acres of tidal natural communities (Objective L1.2, associated with CM2, 3, and 4).
    - Restore or create 5,000 acres of valley/foothill riparian natural community (Objective VFRNC1.1, associated with CM3 and CM7).
    - Protect 750 acres of existing valley/foothill riparian natural community in CZ 7 by year 10 (Objective VFRNC1.2, associated with CM3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-9-61. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 9[a]

Conservation Measure[b]	Habitat Type[c]	Permanent		Temporary		Periodic[e]	
		NT	LLT[d]	NT	LLT[d]	CM2	CM5
CM1	Roosting	74	74	284	284	NA	NA
	Foraging	1,289	1,289	3,583	3,583	NA	NA
Total Impacts CM1		**1,363**	**1,363**	**3,867**	**3,867**	**NA**	**NA**
CM2–CM18	Roosting	524	1,570	167	212	324	411
	Foraging	14,497	60,399	773	2,126	21,265	10,137
Total Impacts CM2–CM18		**15,021**	**61,969**	**940**	**2,338**	**21,589**	**10,548**
TOTAL IMPACTS		**16,384**	**65,391**	**4,807**	**6,205**	**21,589**	**10,548**

[a] See Appendix 12E for a detailed breakdown of conservation measure effects over the BDCP's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable CMs.

[c] Affected roosting habitat acreages include valley/foothill riparian habitat, developed lands, and orchards. An unknown number of buildings, bridges, tunnels, and individual trees could also be affected but were not included in this analysis. Foraging habitat includes all natural communities, cultivated lands, and developed lands in the study area. Foraging habitat effects for CM2-CM18 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands).

[d] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the 50-year life of the BDCP and do not reflect habitat increases that would result from restoration, creation and protection activities.

[e] Periodic effects were estimated for the late long-term only. CM2 periodic impacts are presented as the maximum possible based on different flow regimes at the proposed notch in Fremont Weir.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 9 conservation measure CM1 would result in the permanent and temporary loss combined of up to 358 acres of roosting habitat and 4,872 acres of foraging habitat for special-status bats in the study area. DWR identified 12 bridges that could be affected by Alternative 9 construction in CM1. Conservation measures Fremont Weir/Yolo Bypass improvements (CM2), tidal habitat restoration (CM4), and floodplain restoration (CM5) and would result in the permanent and temporary loss of 1,782 acres of roosting habitat and the conversion of approximately 65,525 acres of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Habitat enhancement and management activities (CM11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other BDCP physical facilities could affect special-status bat habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of Alternative 9 conveyance facilities would result in the permanent loss of approximately 74 acres of roosting habitat and 1,289 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 284 acres of roosting habitat and up to 3,583 acres of foraging habitat for special-status bats in the study area (Table 12-9-61). DWR identified twelve bridges within the area of channel dredging, fish screen, and operable barrier that provide potential roosting habitat that could be affected by construction for CM1. Two of these bridges had positive sign for bats.

- *CM2 Yolo Bypass Fisheries Enhancement*: Improvements in the Yolo Bypass would result in the conversion of approximately 2,025 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM2 would also result in the permanent removal of 89 acres and temporary removal of 167acres of roosting habitat for special-status bats. The maternity colony of Mexican free-tailed bats located at both ends of the Yolo Causeway bridge could also be affected during construction for CM2. Implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would ensure that improvements in the Yolo Bypass avoid effects on roosting special-status bats.

- C*M4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the conversion of approximately 56,810 acres of foraging habitat into wetlands that could still be used by bats for foraging. Approximately 1,425 acres of roosting habitat for special-status bats would permanently affected. This habitat is of low value, consisting of a small, isolated patch surrounded by cultivated lands, and the species has a relatively low likelihood of being present in these areas. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, described below, requires that tidal natural communities restoration avoid effects on roosting special-status bats.

- *CM5 Seasonally Inundated Floodplain Restoration*: Levee construction associated with floodplain restoration would result in the conversion of an estimated 3,690 acres of foraging habitat into wetlands that could still be used by bats for foraging. CM5 would also result in the permanent removal of 57 acres and temporary removal of 45 acres of roosting habitat for special-status bats in the study area.

- *CM11 Natural Communities Enhancement and Management*: Implementation of Alternative 9 would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Yolo Bypass, the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.

- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to conservation components could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other BDCP conservation actions that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would not be adverse under NEPA. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 9 would permanently or temporarily affect 1,049 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (358 acres roosting habitat), CM2 (256acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 784 acres of the 1,049 acres of roosting habitat losses would be in valley/foothill riparian habitat.

Typical NEPA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 784 acres of riparian habitat should be restored and 784 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 9.In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these effects.

The BDCP also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 9 as a whole would affect 2,140 acres of roosting habitat (Table 12-9-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

NEPA Effects: In the near-term the losses of roosting habitat for special-status bats associated with implementing Alternative 9 are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the BDCP has committed to protecting the acreage required to meet the typical mitigation ratios described above. In the late long-term, the losses of roosting habitat for special-status bats associated with Alternative 9, in the absence of other conservation actions, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the conservation components, guided by landscape-scale goals and objectives and by AMM1–AMM6 and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 9 as a whole on special-status bats would not be adverse

***CEQA Conclusion*:**

Near-Term Timeframe

Because water conveyance facilities construction is being evaluated at the project level, the near-term BDCP strategy has been analyzed to determine whether it would provide sufficient habitat protection or restoration in an appropriate timeframe to ensure that the construction effects would be less than significant for CEQA purposes. Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, and CM4 in the near-term.

Alternative 9 would permanently or temporarily affect 1,049 acres of roosting habitat for special-status bats in the near-term as a result of implementing CM1 (358 acres roosting habitat), CM2 (256 acres roosting habitat), and CM4 (435 acres roosting habitat). Effects from CM5 would all occur in the late long-term. Only 784 acres of the 1,049 acres of roosting habitat losses would be in valley/foothill riparian habitat Typical CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 784 acres of riparian habitat should be restored and 784 acres of riparian habitat should be protected.

Implementation of BDCP actions in the near-term would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats (Objective L1.1). BDCP actions in the near-term would restore 800 acres of riparian roosting and foraging habitat (Objective VFRNC1.1) and 21,288 acres of foraging habitat in natural communities and developed lands (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, and Objective L2.11). In addition, the BDCP would protect 750 acres of riparian roosting and foraging habitat (Objective VFRNC1.2) and 41,445 acres of foraging habitat (Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,). Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Conservation components in the near-term would sufficiently offset the adverse effects resulting from near-term effects from Alternative 9.In addition, activities associated with natural communities enhancement and protection and with ongoing facilities operations and maintenance could affect special-status bat use of surrounding habitat and could result in harassment, injury or mortality of bats. Mitigation Measure BIO-166, described below, requires preconstruction surveys to reduce these impacts to a less-than-significant level.

The permanent loss of roosting habitat from Alternative 9 would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The BDCP also contains commitments to implement AMM1–AMM6 and AMM10. These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to the Final EIR/EIS.

Late Long-Term Timeframe

Alternative 9 as a whole would affect 2,140 acres of roosting habitat (Table 12-9-61). Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat for CM1, CM2, CM4, and CM5 in the late long-term.

Implementation of BDCP actions in the late long-term would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 142,200 acres of their foraging and roosting habitats (Objective L1.1). Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this objective is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale., Achieving this objective is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

BDCP actions in the late long-term would restore and protect 5,750 acres of riparian roosting and foraging habitat (Objective VFRNC1.1 and Objective VFRNC1.2), and 136,450 acres of foraging habitat (Objective L1.1, Objective GNC1.2, Objective VPNC1.2, Objective L1.2, Objective L2.11, Objective L1.1, Objective ASWNC1.1, Objective VPNC1.1, Objective MWNC1.1, Objective CLNC1.1, Objective GGS3.1, and Objective GNC1.1,) in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Should any of the special-status bat species roost in the study area, construction of water conveyance facilities and restoration activities could have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of construction activities would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Conservation components would sufficiently offset the adverse effects resulting from late long-term effects from CM1, CM2, CM4, and CM5.

The permanent loss of roosting habitat from Alternative 9 would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure that there would be no significant impact on roosting special-status bats, either directly or through habitat modifications, and that there would be no substantial reduction in numbers or a restriction in the range of special-status bats. Therefore, Alternative 9 would not result in a significant impact on special-status bats under CEQA.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined by DWR in consultation with CDFW and shallinclude, as applicable, measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.

- Disturbance of the bridge will be avoided between March 1 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through October31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bats that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal will be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 31, later tree removal may be considered in consultation with CDFW.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent feasible and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction will be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:
    - Eviction will not occur before September 15th and will match the timeframe for tree removal approved by CDFW.
    - Qualified biologists will carry out or oversee the eviction tasks and monitor the tree trimming/removal.
    - Eviction will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
    - Eviction will take place during weather and temperature conditions conducive to bat activity.
    - Special-status bat roosts will not be disturbed.

  Eviction procedures shall include but are not limited to:

    - Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.

- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Non-injurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats will be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat will also be determined through consultation with CDFW and may include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, "bat bark," planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. "Bat bark" has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Plan Implementation on Special-Status Bats

Construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat over the term of the BDCP.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural community's restoration would potentially indirectly affect special-status bat species. *CM12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *CM12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from BDCP tidal natural community's restoration.

NEPA Effects: Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 9 would not have an adverse effect on special-status bats.

CEQA Conclusion: Indirect effects from conservation components operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, would reduce this impact to a less-than-significant level and ensure Alternative 9 would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Conservation Components

Flooding of the Yolo Bypass from *CM2 Yolo Bypass Fisheries Enhancement* would periodically affect 324 acres of roosting habitat and 21,265 acres of foraging habitat for special-status bats in the study area (Table 12-9-61).

CM5 Seasonally Inundated Floodplain Restoration would periodically inundate up to 411 acres of roosting habitat and 10,137 acres of foraging habitat for special-status bats (Table 12-9-61). Potential roosting trees are likely to be retained within seasonally flooded areas, although high velocity flooding could uproot some trees. Seasonal flooding would not adversely affect foraging habitat for the species. The overall effect of seasonal inundation in existing riparian natural communities may instead be beneficial. Historically, flooding was the main natural disturbance regulating ecological processes in riparian areas, and flooding promotes the germination and establishment of many native riparian plants. In the late long-term, seasonal inundation in areas currently occupied by riparian vegetation may contribute to the establishment of high-value habitat for special-status bats that use riparian habitats.

NEPA Effects: Periodic effects on roosting and foraging habitat for special-status bats associated with implementing Alternative 9 are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address any effects of periodic inundation on special-status bats and roosting habitat. Therefore, Alternative 9 would not adversely affect the species.

CEQA Conclusion: Periodic inundation under CM2 and floodplain restoration under CM5 would periodically affect foraging and roosting habitat for special-status bats in the study area. Any impact of periodic inundation on special-status bats would be mitigated through implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Plant Species

The effects of constructing the water conveyance facilities under Alternative 9 would be substantially different than under any of the other alternatives. However, effects of implementing habitat restoration would be the same as under Alternative 1A.

Vernal Pool Plants

Five covered plant species and 12 noncovered special-status plant species occur in vernal pools in the study area (Tables 12-2, 12-3, summarized in Table 12-9-62). The vernal pool habitat model used for the impact analysis was based on vegetation types and associations from various data sets which were used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which the species are known to occur, including vernal pool complex and degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 9.

Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit covered vernal pool plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Objective VPP1.1, associated with CM3).
- Maintain no net loss of Heckard's peppergrass in Conservation Zones 1, 8, or 11 within restoration sites or within the area of affected tidal range of restoration projects (Objective VPP1.2, associated with CM3 and CM9).

The restoration activities covered under Alternative 9 could have impacts on special-status vernal pool plants. No modeled habitat and no known occurrences of the 17 vernal pool plants are within the proposed footprint for the Alternative 9 water conveyance facilities. Modeled vernal pool habitat would be affected by tidal habitat restoration, although no known occurrences of 17 vernal pool plants are within the hypothetical footprint for restoration activities. Table 12-9-62 summarizes the acreage of modeled vernal pool habitat in the study area, the number of occurrences of each special-status vernal pool plant in the study area, and the potential effects.

Table 12-9-62. Summary of Impacts on Vernal Pool Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Vernal pool complex	9,557	1			Habitat loss from tidal habitat restoration
Degraded vernal pool complex	2,576	370			Habitat loss from tidal habitat restoration
Alkali Seasonal Wetland	188	0			None
Total	**12,321**	**372**			
Covered Species					
Alkali milk-vetch			16	0	None
Dwarf downingia			12	0	None
Boggs Lake hedge-hyssop			1	0	None
Legenere			8	0	None
Heckard's peppergrass			4[a]	0	None
Noncovered Species					
Ferris' milk-vetch			6	0	None
Vernal pool smallscale			2	0	None
Hogwallow starfish			0	0	None
Ferris' goldfields			4	0	None
Contra Costa goldfields			7	0	None
Cotula-leaf navarretia			5	0	None
Baker's navarretia			3	0	None
Colusa grass			1	0	None
Bearded popcorn-flower			5	0	None
Delta woolly marbles			3	0	None
Saline clover			9	0	None
Solano grass			1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Alternative 9 could affect habitat for special-status vernal pool plants. The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No modeled habitat and no known occurrences of the 17 vernal pool plants are within the proposed footprint for the Alternative 9 water conveyance facilities. Therefore, under Alternative 9, construction and operation of the water conveyance facilities would not affect the five covered vernal pool plant or the 12 noncovered special-status plants.

- *CM2 Yolo Bypass Fisheries Enhancement*: No modeled vernal pool habitat and no known occurrences of the 17 vernal pool plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass fisheries enhancements would not affect the covered or noncovered vernal pool plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit covered vernal pool plants by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 (Objective VPNC1.1). The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species. These benefits also would accrue to any noncovered vernal pool plants occurring in the protected vernal pool complex.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would result in the inundation of 372 acres of vernal pool complex and would, therefore, potentially affect special-status vernal pool plants. However, no known occurrences of covered and noncovered vernal pool plants would be affected. Most of this modeled habitat (370 acres) consists of degraded vernal pool habitat that is unlikely to contain special-status plants. In addition, 257.8 acres of critical habitat for Contra Costa goldfields could be affected.
- *CM5 Seasonally Inundated Floodplain Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered vernal pool plants.
- *CM6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered vernal pool plants.
- *CM8 Grassland Natural Community Restoration*: Although the vernal pool complex habitat includes grassland matrix within which the vernal pools occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within vernal pool complex habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered vernal pool plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, BDCP activities result in the net loss of vernal pool habitat, CM9 would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plants would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool plants or affect vernal pool habitat adjacent to the restoration areas.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on covered and noncovered vernal pool plants.

- *Avoidance and Minimization Measures*: Effects on covered vernal pool plants potentially resulting from implementation of CM4 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM12 Vernal Pool Crustaceans*, and *AMM37 Recreation*. AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres through the life of the Plan. AMM12 also requires that that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 will not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM37 requires that new recreation trails avoid populations of covered vernal pool plants.

In addition, the BDCP includes species-specific goals to benefit covered vernal pool plants. This includes protecting two occurrences of alkali milk-vetch (Objective VPP1.1) and requiring no net loss of Heckard's peppergrass (Objective VPP1.2).

In summary, no adverse effects on covered special-status vernal pool plants would be expected from implementing Alternative 9. No known occurrences of 17 special-status vernal pool plants would be affected. Beneficial effects on special-status vernal pool plants could occur by protecting 600 acres of vernal pool complex in CZs 1, 8, and 11 and by protecting occurrences of alkali milk-vetch.

The GIS analysis estimated that up to 371 acres of vernal pool complex could be adversely affected by covered activities under Alternative 9. However, the actual effect on habitat for special-status vernal pool plants is expected to be much less than the estimated impact because the BDCP limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants (Objective VPNC1.2, associated with CM9). This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts. The limitation on the loss of wetted vernal pool habitat will constrain the implementation of tidal restoration projects that are adjacent to vernal pool complex, which could affect the feasibility of restoring 65,000 acres of tidal habitat (Objective TPANC1.1, associated with CM4).

***NEPA Effects*:** Implementation of the BDCP under Alternative 9 would not have an adverse effect on threatened and endangered vernal pool plant species.

***CEQA Conclusion*:** Because loss of modeled habitat for vernal pool plant species would be offset through restoration, and because impacts on occurrences of special-status vernal pool plants would be avoided, implementation of Alternative 9 would not result in a reduction in the range or numbers of 17 covered and noncovered special-status vernal pool plants in the study area. Therefore, impacts on special-status vernal pool plants be less than significant. No mitigation is required.

Alkali Seasonal Wetland Plants

Five covered species and three noncovered plants occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-9-63). Alkali seasonal wetland habitat was modeled separately for four covered plant species occurring in seasonal alkali wetlands.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit covered alkali seasonal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Of the 150 acres of alkali seasonal wetland complex protected under Objective ASWNC1.1, 600 acres of vernal pool complex protected under Objective VPNC1.1, and 8,000 acres of grassland natural community protected under Objective GNC1.1, protect at least 75 acres of suitable brittlescale habitat and 75 acres of suitable heartscale habitat in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.1, associated with CM3).
- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Objective BRIT/HART/SJSC1.2, associated with CM3).

No adverse effects on Delta button celery, crownscale, palmate-bracted bird's-beak or recurved larkspur would be expected. Table 12-9-63 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland plant in the study area.

Table 12-9-63. Summary of Impacts on Seasonal Alkali Wetland Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	680			Habitat loss from tidal habitat restoration, Yolo Bypass fisheries enhancements, and levee construction
Brittlescale modeled habitat	451	4			Habitat loss from tidal habitat restoration
Heartscale modeled habitat	6,528	306			Habitat loss from tidal habitat restoration and Yolo Bypass fisheries enhancements
Delta button celery modeled habitat	3,330[a]	0			None
Alkali seasonal wetlands	3,273	72			Habitat loss from tidal habitat restoration and Yolo Bypass fisheries enhancements
Covered Species					
San Joaquin spearscale			19	1	Population loss from tidal habitat restoration
Brittlescale			8	0	None
Heartscale			3	0	None
Delta button celery			1[b]	0	None
Heckard's peppergrass			1[c]	1	Population loss from tidal habitat restoration
Noncovered Species					
Crownscale			17	0	None
Palmate-bracted bird's-beak			1	0	None
Recurved larkspur			4	0	None

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Alternative 9 would have adverse effects on modeled seasonal alkali wetland habitat for San Joaquin spearscale, brittlescale, and heartscale. It could also have adverse effects on occurrences of San Joaquin spearscale and Heckard's peppergrass.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for construction of the water facilities or channel dredging. Therefore, construction and operation of the water conveyance facilities would have no impacts on covered and noncovered alkali seasonal wetland plant species.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries improvements would permanently remove 56 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No modeled habitat and no known occurrences of the seven other alkali seasonal wetland plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to benefit alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland in Conservation Zones 1, 8, and/or 11. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration is expected to convert alkali seasonal wetlands on the margins of tidal wetlands to freshwater or brackish tidal marsh. Tidal habitat restoration would convert 680 acres of modeled habitat for San Joaquin spearscale to tidal marsh. Tidal habitat restoration would permanently remove 4 acres of modeled habitat for brittlescale in CZ 1 near Lindsey Slough and in CZ 11 near Nurse Slough; however, the BDCP would allow up to 50 acres of modeled habitat to be converted to tidal wetlands. Tidal habitat restoration would remove 306 acres of modeled habitat for heartscale in CZ 1 in the vicinity of Jepson Prairie and in CZ 11 adjacent to Suisun Marsh. The extent to which the modeled habitat is actually occupied by these species is not known; modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. Tidal habitat restoration could adversely affect an occurrence of Heckard's peppergrass at Hass Slough and an occurrence of San Joaquin spearscale at Main Prairie, both in CZ 1. These occurrences are based on historic records, and the whether or not the populations still exist is not known. In each case, the loss of modeled habitat and occurrences for covered species would be adverse effects. Delta button celery, crownscale, palmate-bracted bird's-beak, and recurved larkspur would not be affected by tidal habitat restoration.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the removal of 2 acres of modeled habitat for San Joaquin spearscale. No known occurrences of San Joaquin spearscale would be affected. No other alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for floodplain restoration. Therefore, floodplain restoration and construction of new

floodplain levees would have no impacts on covered and noncovered alkali seasonal wetland plants.

- *CM6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM8 Grassland Natural Community Restoration*: Although the alkali seasonal wetland habitat includes the grassland matrix within which the wetlands occur, grassland restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands that are not included within alkali seasonal wetland habitat. Therefore, grassland communities restoration would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants. In addition, the BDCP would compensate for the loss of alkali seasonal wetlands from other CMs by restoring or creating 72 acres of alkali seasonal wetlands in Conservation Zones 1, 8, or 11 to achieve no net loss of this habitat.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on covered and noncovered alkali seasonal wetland plants.
- *Avoidance and Minimization Measures*: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of CM4 would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of covered species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM37 requires that new recreation trails avoid populations of covered alkali seasonal wetland plants.

In summary, one historic occurrence of Heckard's peppergrass and one historic occurrence of San Joaquin spearscale could be affected by tidal restoration activities, if those occurrences still exist. AMM11 would be implemented to avoid an adverse effect on the Heckard's peppergrass and San Joaquin spearscale occurrences.

The primary effect of Alternative 9 on special-status alkali seasonal wetland plants would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. Approximately 72 acres of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland plants is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the BDCP limits the total loss of wetted vernal pool habitat to 10 acres (approximately 67 acres of vernal pool complex) over the permit term (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex (Objective VPNC1.2, associated with CM9). Approximately 72 acres of alkali seasonal wetlands would be restored (Objective ASWC1.2, associated with CM9). Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis (Objective GNC1.1, associated with CM8). These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

Alternative 9 would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting 150 acres of alkali seasonal wetland habitat. The BDCP also includes the species-specific goals that 75 acres of the protected alkali seasonal wetland habitat would be modeled habitat for brittlescale and heartscale (Objective BRIT/HART/SJSC1.1) and that 2 occurrences of San Joaquin spearscale would be protected (Objective BRIT/HART/SJSC1.2). The benefits of habitat protection and management also would accrue to any noncovered alkali seasonal wetland plants occurring in the protected habitat.

***NEPA Effects*:** Under Alternative 9, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (CM8, CM9), and impacts on one occurrence of San Joaquin spearscale and one occurrence of Heckard's peppergrass would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse.

***CEQA Conclusion*:** Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of covered alkali seasonal wetland plants would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 9, would not result in substantially reducing the number or restricting the range of five covered and three noncovered plant species, and this impact would be less than significant. No mitigation is required.

Grassland Plants

One covered plant and 11 noncovered special-status plants occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-9-64). The only covered plant species occurring in grassland is Carquinez goldenbush. Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extend of alluvium deposits in close proximity to the actual rivers/streams.

Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit covered grassland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- Protect three unprotected occurrences of the Carquinez goldenbush in Conservation Zones 1 and/or 11 (Objective CGB1.1, associated with CM3).
- Maintain and enhance occupied Carquinez goldenbush habitat to slow erosion and reverse degradation from livestock grazing (Objective CGB1.2, associated with CM11).

Of 78,047 acres of grasslands in the study area, Alternative 9 would adversely affect 2,706 acres under Alternative 9, including 4 acres that are modeled habitat for Carquinez goldenbush. For 10 of the plants, no known occurrences would be affected. One of five Parry's rough tarplant occurrences in the study area could be affected by Alternative 9. Table 12-9-64 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland plant in the study area.

Table 12-9-64. Summary of Impacts on Grassland Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	4			Habitat loss from tidal habitat restoration
Grassland	78,047	2,706			Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, floodplain restoration, and construction of conservation hatcheries facilities
Covered Species					
Carquinez goldenbush			10	1	Occurrence affected by tidal restoration
Noncovered Species					
Big tarplant			5	0	None
Round-leaved filaree			2	0	None
Pappose tarplant			7	0	None
Parry's rough tarplant			5	1	Periodic inundation of one occurrence as a result of Yolo Bypass operations
Small-flowered morning-glory			0	0	None
Diamond-petaled poppy			1	0	None
Stinkbells			1	0	None
Fragrant fritillary			4	0	None
Gairdner's yampah			0	0	None
Streamside daisy[a]			1	0	None
Caper-fruited tropidocarpum			8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified in the BDCP.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plant Species

Alternative 9 could have adverse effects on modeled habitat for Carquinez goldenbush. It could also affect one occurrence of Carquinez goldenbush and one occurrence of Parry's rough tarplant. Although Alternative 9 would have no expected effects on known occurrences of the other special-status plant species that occur in grasslands, the loss of 3,389 acres of grassland would have the potential to adversely affected undocumented populations of special-status grassland species.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland plants are within the proposed footprint for the Alternative 9 water conveyance facilities. About 427 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 9, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland plants.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 627 acres of grassland habitat. Yolo Bypass operations would result in more frequent and longer inundation of 1,597 acres of grasslands in the Yolo Causeway (CZ 2) that include habitat for one occurrence of Parry's rough tarplant. Parry's rough tarplant is a summer-blooming plant that occurs in areas subject to occasional inundation during the wet season, such as swales and seasonal wetlands. Increasing the frequency or duration of inundation may decrease the distribution in some areas by making some conditions too wet but would also expand the distribution into areas that may currently be too dry. Overall, changing the frequency and duration of inundation in the area of this occurrence should not result in a substantial change in the range of numbers of Parry's rough tarplant. Construction and operation of the Yolo Bypass fisheries enhancements would not affect modeled habitat for Carquinez goldenbush or known occurrences of other special-status grassland plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to preserve 8,000 acres of grassland habitat, some of which may contain modeled habitat for Carquinez goldenbush. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 1,122 acres of grassland habitat Four acres of modeled habitat for Carquinez goldenbush along the eastern side of Suisun Marsh could be loss as a result of habitat conversion, including part of one known occurrence. Tidal restoration would have not affect other known occurrences of special-status grassland plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Construction of new floodplain levees would result in the loss of 85 acres of grassland habitat, and periodic inundation of the floodplain would affect 513 acres of grassland habitat,. However, no modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for floodplain restoration, and the affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, floodplain restoration and construction of new floodplain levees would have no impacts on covered and noncovered grassland plants.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel

margin habitat enhancement would have no impacts on covered and noncovered grassland plants.

- *CM7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. About 401 acres of grassland habitat would be converted to riparian habitat. The affected grassland habitat consists of herbaceous ruderal vegetation that does not support special-status grassland plants. Therefore, riparian habitat enhancement would have no impacts on covered and noncovered grassland plants.
- *CM8 Grassland Natural Community Restoration*: Grassland restoration would restore 2,000 acres of grassland habitat. Restoration activities would take place in non-grasslands (ruderal habitat, cultivated land) or degraded grasslands. These areas do not currently provide habitat for special-status grassland plants. Therefore, grassland community restoration would have no impacts on covered and noncovered grassland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plants would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on covered and noncovered grassland plants.
- *CM18 Conservation Hatcheries*: Construction of the conservation hatcheries would remove 35 acres of grassland habitat. The removed habitat would consist of ruderal herbaceous vegetation that would not be likely to provide habitat for special-status grassland plants. Therefore, construction of the conservation hatcheries would not be expected to affect special-status grassland plants.
- *Avoidance and Minimization Measures*: Effects on Carquinez goldenbush potentially resulting from implementation of CM4 and potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. AMM37 requires that new recreation trails avoid populations of Carquinez goldenbush.

The primary effect of Alternative 9 on special-status grassland plants is the loss of potential (i.e., modeled) habitat for Carquinez goldenbush, including part of one known occurrence. Adverse effects on the occurrence will be minimized through AMM11. Protecting three unprotected occurrences of Carquinez goldenbush (Objective CGB1.1, associated with CM3) and maintaining and enhancing occupied Carquinez goldenbush (Objective CGB1.2, associated with CM11) would compensate for any residual effects. One occurrence of Parry's rough tarplant would be affected by CM2, but the effect is not expected to be adverse. No known occurrences of the other special-status grassland plants would be affected.

Alternative 9 would have a potential beneficial effect on special-status grassland plants by protecting 8,000 acres of grassland habitat. To ensure that this habitat preservation would specifically benefit Carquinez goldenbush, the plan proposes to protect three Carquinez goldenbush occurrences in CZs 1 and 11 that are currently not protected and to maintain and enhance occupied Carquinez goldenbush habitat. The preservation of modeled or potential habitat, together with avoidance and minimization of impacts on species occurrences, would reduce any effects Alternative 9 on covered grassland plants to a level that is no longer adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for Carquinez goldenbush would be offset through CM3, CM8, and CM11. Therefore, implementation of Alternative 9 would result in no adverse effects on special-status grassland plants.

***CEQA Conclusion*:** Because adverse effects on special-status grassland plant species would be avoided or compensated for, Alternative 9 would not result in substantially reducing the numbers or restricting the range of one covered or 11 noncovered special-status grassland plants, and this impact would be less than significant. No mitigation is required.

Valley/Foothill Riparian Plants

Two covered plants and two noncovered special-status plants occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-9-65). The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit covered valley/foothill riparian plants (BDCP Chapter 3 Section 3.3, *Biological Goals and Objectives*).

- Protect and enhance two occurrences of delta button celery. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of delta button celery for a total of two occurrences within the restored floodplain habitat on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis. (Objective DBC1.1, associated with CM3 and CM11)
- Protect and enhance two occurrences of slough thistle. If occurrences are not found in the Plan Area, establish self-sustaining occurrences of slough thistle for a total of two occurrences within the 10,000 acres of restored floodplain on the mainstem of the San Joaquin River in Conservation Zone 7 between Mossdale and Vernalis (Objective ST1.1: associated with CM3 and CM11).

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 9 would adversely affect 1,116 acres, including 15 acres that are modeled habitat for Delta button-celery and 11 acres that are modeled habitat for slough thistle. Table 12-9-65 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status grassland plant in the study area.

Table 12-9-65. Summary of Impacts on Valley/Foothill Riparian Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button celery modeled habitat	3,361[a]	15			Habitat loss from floodplain restoration
Slough thistle modeled habitat	1,834	11			Habitat loss from floodplain restoration
Valley/foothill riparian habitat	17,966	1,116			Habitat loss from construction of water conveyance facilities, tidal restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta button celery			1[b]	1	Occurrence potentially affected by floodplain restoration
Slough thistle			2	2	Occurrences potentially affected by floodplain restoration
Noncovered Species					
Northern California black walnut			1	0	None
Wright's trichocoronis			1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland
[b] A second occurrence is in alkali seasonal wetland

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plants are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would be affected by restoration of seasonally inundated floodplain.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the water conveyance facilities would remove 310 acres of valley-foothill riparian habitat under Alternative 9. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the proposed footprint for the Alternative 9 water conveyance facilities. Therefore, under Alternative 9, construction and operation of the water conveyance facilities would not affect covered or noncovered special-status valley/foothill riparian plants.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction and operation of the Yolo Bypass fisheries enhancements would adversely affect 176 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass fisheries enhancements would not affect the covered or noncovered valley/foothill riparian plants.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes to protect 552 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 552 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the hypothetical footprint for tidal restoration. Therefore, tidal restoration would not affect the covered or noncovered valley/foothill riparian plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove about 78 acres of valley/foothill riparian habitat, including 15 acres of modeled habitat for Delta button-celery along the San Joaquin River in CZ 7. In addition, floodplain restoration would result in more frequent and longer inundation of 18 acres of modeled habitat for Delta button-celery in this area. The area affected contains one historic occurrence of Delta button celery. This occurrence is considered to be extirpated, because all habitat for Delta button-celery at his location has been converted to agriculture (California Department of Fish and Wildlife 2013). Therefore, Alternative 9 would not have an adverse effect on Delta button celery in CZ 7.

  The BDCP proposes to benefit Delta button-celery at this location by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of Delta button-celery. Although Delta button celery occurs in riparian habitat, it is not associated with woodland or scrub habitats; rather, it occurs in alkali seasonal wetlands in floodplains, which may or may not also contain adjacent woody riparian habitat. Restoring habitat for Delta button-celery may not be compatible with restoring woody riparian habitat. In addition, establishing new populations of Delta button-celery is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on Delta button-celery would be speculative.

  Floodplain restoration levee construction would remove 11 acres of modeled habitat for slough thistle and would result in more frequent and longer inundation of 6 acres of modeled habitat for slough thistle along the San Joaquin River in CZ 7. However, the BDCP would allow up to 50 acres of modeled habitat to be converted to riparian habitat. Whether the affected modeled habitat is actually occupied by slough thistle is not known; however, of two historic occurrences of slough thistle present in the study area, only one is considered to be extirpated (California Department of Fish and Wildlife 2013). The BDCP would protect and enhance two occurrences of slough thistle. If occurrences are not found in the study area, then two, self-sustaining occurrences of slough thistle would be established using locally-sourced genetic material for a total of two occurrences within the restored floodplain habitat on the main stem of the San Joaquin River in CZ 7 between Mossdale and Vernalis. Establishing new populations of slough thistle is an untried, unproven procedure and may not be feasible. Therefore, any beneficial effects on slough thistle would be speculative.

One historic occurrence of Wright's trichocoronis in the study area near Lathrop (CZ 7) could also be affected by floodplain restoration. The occurrence is presumed to be extant because the presence or absence of suitable habitat has not been verified by field surveys (California Department of Fish and Wildlife 2013). However, the species has not been observed at this location for nearly a century, and habitat for Wright's trichocoronis, which would have been similar to that for Delta button celery and slough thistle, no longer appears to be present in aerial photographs of the area. Therefore, Alternative 9 would not be expected to have an adverse effect on Wright's trichocoronis.

- *CM6 Channel Margin Habitat Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM8 Grassland Natural Community Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plants are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered valley/foothill riparian plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on covered and noncovered valley/foothill riparian plants.
- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of CM5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 9 is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for covered plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 9 would not have an adverse effect on these species.

The BDCP proposes to benefit Delta button-celery and slough thistle by restoring 5,000 acres of valley/foothill riparian habitat and re-introducing two occurrences of both species. Establishing new populations of Delta-button-celery or slough thistle would be a beneficial effect. However, establishing new populations is an untried, unproven procedure and may not be feasible.

NEPA Effects: Implementation of the BDCP under Alternative 9 would not have an adverse effect on special-status valley/foothill riparian plant species.

CEQA Conclusion: Alternative 9 would not result in a reduction in the range and numbers of covered and noncovered valley/foothill riparian plants. This impact would be less than significant. No mitigation is required.

Tidal Wetland Plants

Seven covered plants and one noncovered special-status plant occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-9-66). Five tidal wetland habitat models were developed for the seven covered plant species occurring in tidal wetland habitat.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitat cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 9 would include the following conservation actions over the term of the BDCP to benefit covered tidal wetland plants (BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*).

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites, or within the area of affected tidal range of restoration projects (Objective DMW/ML1.1, associated with CM4 and CM11).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Objective DTP/SMA1.1, associated with CM4 and CM11).
- Restore tidal inundation to wetlands in the Hill Slough Ecological Reserve and to the ponded area at Rush Ranch (Objective SBB/SuT1.1, associated with CM4).
- Complete seed banking of all existing Suisun Marsh populations and the representative genetic diversity using accepted seed banking protocols (Objective SBB/SuT1.2, associated with CM11).
- Establish a cultivated population of Suisun thistle from wild seed using accepted seed collection protocols (Objective SBB/SuT1.3, associated with CM11).
- Establish two occurrences of Suisun thistle in Conservation Zone 11 (Objective SBB/SuT1.4, associated with CM11).

Of 17,357 acres of tidal wetlands in the study area, Alternative 9 would affect 193 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, Suisun Marsh aster, soft bird's-beak, and Suisun thistle. Known occurrences of all of these species would be affected. In addition, three occurrences of Bolander's water-hemlock, a noncovered special-status plant, could be affected by tidal habitat restoration. Table 12-9-66 summarizes the acreage of modeled habitat for covered tidal wetland species and the number of occurrences of each special-status tidal wetland plants in the study area.

Table 12-9-66. Summary of Impacts on Tidal Wetland Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/ Mason's lilaeopsis modeled habitat	6,081	163			Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Side-flowering skullcap modeled habitat	2,497	173			Habitat loss from construction of water conveyance facilities, conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Soft bird's-beak modeled habitat	1,228	73			Habitat loss from tidal habitat restoration
Delta tule pea/ Suisun Marsh aster modeled habitat	5,853	26			Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Suisun thistle modeled habitat	1,281	73			Habitat loss from tidal habitat restoration

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Tidal brackish emergent wetland	8,501	0			None
Tidal freshwater emergent wetland	8,856	193			Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Covered Species					
Delta mudwort			58	10	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Delta tule pea			106	30	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Mason's lilaeopsis			181	27	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Side-flowering skullcap			12	1	Occurrences affected by construction of water conveyance facilities
Soft bird's-beak			13	7	Occurrences affected by tidal habitat restoration
Suisun Marsh aster			164	27	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration
Suisun thistle			4	0	None
Noncovered Species					
Bolander's water hemlock			8	3	Occurrences affected by construction of water conveyance facilities and tidal habitat restoration

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 9 would have adverse effects on tidal marsh special-status plants through implementation of CM1, CM2, CM4, and CM5. No adverse effects are expected from implementation of CM3, CM6, CM7, CM8, and CM9.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would remove 163 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 173 acres of modeled habitat for side-flowering skullcap, and 26 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, 12 occurrences of Mason's lilaeopsis, eight occurrences of Delta mudwort, one occurrence of Suisun Marsh aster, two occurrences of side-flowering skullcap, and one occurrence of Bolander's water-hemlock in the study area could be affected by construction impacts. No known occurrences of soft bird's-beak or Suisun thistle would be affected by construction of the water conveyance facilities.

- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would remove 5 acres of modeled habitat for Mason's lilaeopsis and delta mudwort. The extent to which modeled habitat is actually occupied by these species is not known; however, no known occurrences in the study area would be affected. Yolo Bypass operations would result in more frequent and longer inundation of 8 acres of modeled habitat Delta tule peas and Suisun Marsh aster. Two occurrences of Suisun Marsh aster would be affected by Yolo Bypass operations. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.
- *CM3 Natural Communities Protection and Restoration*: The BDCP proposes restoring or creating 20 linear miles of transitional tidal areas within other natural communities that would be created or restored, including 6,000 acres of tidal brackish emergent wetland and 24,000 acres of tidal freshwater emergent wetland. In addition, the habitat and ecosystem functions of these areas would be maintained and enhanced. The BDCP does not specifically propose to protect any occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences. Instead, the BDCP assumes that the 20 linear miles of restored transitional tidal areas will be passively colonized by the covered tidal wetland plants.
- *CM4 Tidal Natural Communities Restoration*: Tidal habitat restoration would permanently remove 6 acres of modeled habitat for Mason's lilaeopsis and Delta mudwort. Habitat loss would occur through conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 14 of 176 known occurrences of Mason's lilaeopsis and three of 57 known occurrences of delta mudwort in the study area could be affected by tidal habitat restoration.

  Tidal habitat restoration would remove 4 acres of modeled habitat for side-flowering skullcap. Whether the affected modeled habitat is actually occupied by side-flowering skullcap is not known; however, none of the 12 known occurrences in the study area would be affected.

  Tidal habitat restoration would remove 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. However, the BDCP would allow up to 50 acres of modeled habitat to be removed. Habitat loss would result from conversion of the species habitat (at and immediately above the tidal zone in marshes and along rivers and streams) to inundated tidal habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, 26 of 112 known occurrences of Delta tule pea and 24 of 145 occurrences of Suisun Marsh aster in the study area would be affected.

  Tidal habitat restoration could affect 73 acres of modeled habitat for soft bird's-beak and Suisun thistle, including 1.3 acres of critical habitat. The extent to which modeled habitat is actually occupied by the species is not known; however, seven of 12 known occurrences of soft bird's-beak in the study area could be affected. None of the four known occurrences of Suisun thistle in the study area would be affected.

Tidal habitat restoration could affect three of eight known occurrences of Bolander's water-hemlock, a noncovered special-status species in the study area. Because Bolander's water-hemlock occurs in tidal marsh, it may benefit from tidal marsh restoration. However, site preparation, earthwork, and other site activities could adversely affect Bolander's water-hemlock through direct habitat removal.

- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would remove 3 acres of modeled habitat for Mason's lilaeopsis and delta mudwort and 2 acres of modeled habitat for side-flowering skullcap. No known occurrences of these species in the study area would be affected by floodplain restoration.

  Floodplain restoration would result in more frequent and longer inundation of 2 acres of modeled habitat for Mason's lilaeopsis and delta mudwort, 18 acres of modeled habitat for side-flowering skullcap, and 1 acre of modeled habitat for Delta tule peas and Suisun Marsh aster. No known occurrences of these species in the study area would be affected by periodic inundation of restored floodplain habitat. Habitat for these species is normally periodically inundated or saturated; therefore, a small increase in the frequency and duration of periodic inundation of the habitat would not be expected to have a substantial effect.

- *CM6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed separately from the effects of tidal habitat restoration. Channel margin enhancement would have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would have beneficial effects on these species by improving the habitat functions for these species as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.

- *CM7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of CM4 and CM5. Riparian plantings carried out for CM7 would be placed in floodplain areas, not in tidal wetlands.

- *CM8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on covered and noncovered tidal wetland plants.

- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on covered and noncovered tidal wetland plants.

- *Avoidance and Minimization Measures*: Effects on covered tidal wetland plants potentially resulting from implementation of CM1, CM2, CM4, and CM5 would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring, AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines,* and *AMM37 Recreation*. Under AMM11, surveys for covered plant species would be performed during the planning phase of projects, and any impacts on populations of covered species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 contains specific guidance to avoid adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis. AMM37 requires that new recreation trails avoid populations of covered tidal wetland plants.

In summary, the GIS analysis indicates that Alternative 9 would result in the loss of modeled habitat for all of the covered species and result in adverse effects on known occurrences of most of the special-status plants occurring in tidal wetlands. However, the BDCP predicts that habitat restoration activities would greatly expand the amount of habitat available to each of these species, offsetting any potential loss of habitat or occurrences resulting from covered activities.

Delta mudwort could lose 163 acres of modeled habitat (2.7%), including all or part of ten occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta mudwort, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11–CM21, associated with CM11).

Mason's lilaeopsis could lose 163 acres of modeled habitat (2.7%), including all or part of 27 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Mason's lilaeopsis; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DMW/ML1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11–CM21, associated with CM11).

Delta tule pea could lose 26 acre of modeled habitat (0.4%), including all or part of 30 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Delta tule pea, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Delta tule pea; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would take place and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11–CM22, associated with CM11).

Suisun Marsh aster could lose 26 acre of modeled habitat (0.4%), including all or part of 27 occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun Marsh aster, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for Suisun marsh aster; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, the BDCP predicts that natural expansion of populations into the restored habitat would occur and result in no net loss of occurrences (Objective DTP/SMA1.1, associated with CM11). Post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done to confirm that no net loss of occurrences has been achieved (Monitoring Action CM11–CM22, associated with CM11).

All four of these species (Delta mudwort, Mason's lilaeopsis, Delta tule pea, and Suisun Marsh aster) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring large areas of habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected (less than 1% of the total), it is likely that the initial adverse effects of covered activities on these species would be offset and that the overall effect of Alternative 9 on these species would not be adverse.

Side-flowering skullcap could lose 173 acres of modeled habitat (7%), including all or part of one occurrence. Under AMM11, this occurrence would be surveyed for, and because this is a tidal freshwater wetland species, avoidance of the habitat during project construction would be highly likely. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by side-flowering skullcap, which could offset this habitat loss. Channel margin enhancement (CM6) and riparian natural community restoration (CM7) will also consider the potential for creating habitat for side-flowering skullcap; creation of suitable habitat under these measures could also help offset this habitat loss. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, and because loss of modeled habitat for the species would be offset through restoration, the overall effect of Alternative on this species would not be adverse.

Soft bird's-beak could lose 73 acres of modeled habitat (6%), including all or part of seven occurrences. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by soft bird's-beak, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve would be done to increase potential habitat there for soft bird's-beak (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for soft bird's-beak. Although no active restoration of this species is proposed, post-implementation monitoring of soft bird's-beak occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11–CM22, associated with CM11). Soft bird's-beak has a restricted distribution in the study area with highly localized occurrences, and habitat modification is the primary factor responsible for the species' decline and limiting the species' distribution and abundance. Improving habitat functions for this species would provide a reasonable expectation that the distribution and abundance of soft bird's-beak would also improve. Although a substantial amount of modeled habitat could be affected, the primary habitat for soft bird's-beak is high tidal brackish marsh, and the affected habitat is low tidal brackish marsh. Therefore, it is likely that the overall effect of Alternative 9 on this species would not be adverse.

Suisun thistle could lose 73 acres of modeled habitat (6%), although no occurrences would be affected. The BDCP predicts that tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) would increase the extent of habitat available for colonization by Suisun thistle, which could offset this habitat loss. Tidal restoration in the Hill Slough Ecological Reserve and at Rush Ranch would be done to increase potential habitat there for Suisun thistle (Objective SBB/SuT1.1, associated with CM4). In addition, activities to control invasive plants and manage livestock in tidal marsh habitat under CM11 could enhance habitat for Suisun thistle. In addition, two new occurrences of Suisun thistle would be established in CZ 11 (Objective SBB/SuT1.4, associated with CM11). Post-implementation monitoring of Suisun thistle occurrences in proximity to tidal restoration sites would be done to confirm that occurrences are stable or increasing (Monitoring Action CM11–CM22, associated with CM11). Habitat restoration, enhancement of habitat functions, and establishment of new occurrences would offset any potential loss of modeled habitat for Suisun Marsh thistle.

Three occurrences of Bolander's water-hemlock could be affected. Although the extent of potential habitat affected was not determined, it would be comparable to that for Delta tule pea and Suisun Marsh aster (5 acres). Tidal habitat restoration activities proposed under CM4 (Objectives TBEWNC1.1 and TFEWNC1.1) could increase the extent of habitat available for colonization by Bolander's water-hemlock, which could offset this habitat loss. Because only a few scattered occurrences of Bolander's water-hemlock are present in the study area, there is no reasonable expectation that habitat restoration without active species-specific restoration activities would result in the establishment of new occurrences to offset the losses. Also, because Bolander's water-hemlock is a noncovered species, the species protections and occurrence monitoring afforded to covered species under the BDCP would not apply to this species. Therefore, the effects of Alternative 9 on Bolander's water hemlock could be adverse.

NEPA Effects: The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (CM4). Therefore, implementation of Alternative 9 would result in no adverse effects on seven of eight special-status grassland plants in the study area. Alternative 9 would result in a reduction in the range and numbers of Bolander's water-hemlock, which would be an adverse effect. Adverse effects on Bolander's water-hemlock could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of occurrences and modeled habitat for covered tidal habitat plant species would be offset through habitat restoration, impacts on covered tidal wetland plants as a result of implementing Under Alternative 9 would not be significant. However, the loss of Bolander's water-hemlock populations in CZ 11 would result in a reduction in the range and numbers of this species and would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plants, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppy and caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for the special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered plants if feasible. The purpose of these surveys will be to verify that the locations of special-status plants identified in previous record searches or surveys are extant, identify any new special-status plant occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plants will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of covered fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having noncovered special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasible through the establishment of 250-foot activity exclusion zones surrounding the periphery of occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be established according to a 250-foot buffer surrounding the periphery of each plant species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.
- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of

the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Inland Dune Plants

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 9 would have no adverse effects on inland dune plants (Table 12-9-67). No construction activities or habitat restoration would take place where the species occur. No specific actions to benefit inland dune species are proposed.

Table 12-9-67. Summary of Impacts on Inland Dune Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Modeled Habitat					
Inland Dunes	19	0			None
Noncovered Species					
Hoover's cryptantha			1	0	None
Antioch Dunes buckwheat			1	0	None
Mt. Diablo buckwheat			1	0	None
Contra Costa wallflower			3	0	None
Antioch Dunes evening-primrose			9	0	None

NEPA Effects: Implementation of the BDCP under Alternative 9 would not affect special-status inland dune plant species.

CEQA Conclusion: Implementation of Alternative 9 would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Plants

No covered plant species occur in nontidal wetlands in the study area; however, six noncovered special-status plant species occur in nontidal wetlands in the study area. Table 12-9-68 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland plant in the study area.

Table 12-9-68. Summary of Impacts on Nontidal Wetland Plants under Alternative 9

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	269			Loss of habitat from construction of Yolo Bypass fisheries enhancements, tidal habitat restoration, and floodplain restoration
Nontidal freshwater perennial emergent wetland	1,509	151			Loss of habitat from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Noncovered Species					
Watershield			3	0	None
Bristly sedge			18	1	Loss of habitat from construction of water conveyance facilities
Woolly rose-mallow[a]			121	14	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration
Eel-grass pondweed			1	1	Loss of habitat from construction of water conveyance facilities
Sanford's arrowhead			23	2	Loss of habitat from construction of water conveyance facilities, tidal habitat restoration
Marsh skullcap[a]			5	1	Loss of habitat from construction of water conveyance facilities

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 9, known occurrences eel-grass pondweed, bristly sedge, woolly rose-mallow, Sanford's arrowhead, and marsh skullcap would be within the proposed footprint for the water conveyance facilities or within the hypothetical footprint for restoration activities and would be adversely affected. Alternative 9 would have no adverse effects on watershield.

The individual effects of each relevant conservation measure are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual conservation measure discussions.

- *CM1 Water Facilities and Operation*: Under Alternative 9, the primary effect on noncovered plants would be the loss of occupied habitat as a result of in-stream island dredging and construction of operable barriers. One occurrence of bristly sedge in CZ 5 would be adversely affected by construction of a temporary access road. One occurrence of Sanford's arrowhead in CZ 5 would be adversely affected by installation of an operable barrier and associated transmission lines. Thirteen occurrences of woolly rose-mallow would be affected by channel dredging, construction of operable barriers, and other construction activities: five in CZ 6, one in

CZ 5, one in CZ 4, and six in CZ 8. One occurrence of eel-grass pondweed at the Webb Tract and one occurrence of marsh skullcap on the Middle River are present within areas in CZ 6 that would be affected by construction of water conveyance facilities. The locations of these two occurrences are not known with certainty (i.e., nonspecific occurrences), so the likelihood or extent of the impact cannot be determined.

- *CM2 Yolo Bypass Fisheries Enhancement*: No known occurrences of special-status nontidal wetland plants are present in the hypothetical footprint for construction or operation of the Yolo Bypass fisheries enhancements. Therefore, construction and operation of the Yolo Bypass Fisheries enhancements would not affect special-status nontidal marsh plants.
- *CM3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under the BDCP. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *CM4 Tidal Natural Communities Restoration*: One known occurrence of Sanford's arrowhead is present within areas that could be affected by tidal habitat restoration in CZ 2. One known occurrence of woolly rose-mallow is present within areas that could be affected by tidal habitat restoration in CZ 7. No other known occurrences of special-status nontidal wetland plants are present within areas proposed for tidal habitat restoration. Therefore, tidal habitat restoration could have adverse effects on three special-status nontidal wetland plants.
- *CM5 Seasonally Inundated Floodplain Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for floodplain restoration.
- *CM6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status nontidal wetland plants.
- *CM7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status nontidal wetland plants.
- *CM8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland plants.
- *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status nontidal wetland plants.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. The BDCP may benefit nontidal wetland species by creating 400 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for covered and other native species. However, no specific actions to benefit noncovered species are proposed.

Under Alternative 9, 1,500 acres of nontidal marsh would be restored (Objective NFEW/NPANC1.1, addressed under CM10). However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to bristly sedge, woolly rose-mallow, eel-grass pondweed, marsh skullcap, and Sanford's arrowhead, potential loss of habitat or occurrences resulting from covered activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under the BDCP, the species protections afforded to covered species under the AMMs do not apply to these species, and the effects of Alternative 9 on these species would be adverse.

NEPA Effects: Implementation of the BDCP under Alternative 9 could result in a reduction in the range and numbers of bristly sedge, woolly rose-mallow, eel-grass pondweed, marsh skullcap, and Sanford's arrowhead, five noncovered nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Under Alternative 9, construction of the water conveyance facilities and tidal habitat restoration would result in a reduction in the range and numbers of bristly sedge, woolly rose-mallow, eel-grass pondweed, marsh skullcap, and Sanford's arrowhead. These impacts would be significant. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species*, would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-173.

General Terrestrial Biology Effects

Wetlands and Other Waters of the United States

Alternative 9 actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The Section 404 regulations and relevant information regarding mitigation of impacts on wetlands and waters of the United States are described in Section 12.2.1.1. The following two impacts address the project-level effects of CM1 on these potential wetlands and waters, and the programmatic-level effects of other relevant conservation actions (CM2–CM10). CM11–CM21 would not directly result in loss or conversion of wetlands or other waters of the United States. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. The waters of the United States data used for this analysis is based on a verified wetland delineation from USACE that was completed in early 2015. These waters of the United States were mapped at finer scale than that which was done for the natural community mapping for the BDCP; therefore, the acreages of these two datasets differ. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities (CM1) on Wetlands and Other Waters of the United States

Alternative 9 proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-9-69. Based on the methodology used to conduct this analysis, these effects would occur at channel dredging sites, canal construction sites, operable barrier construction sites and channel widening sites throughout the study area, and at multiple temporary work areas associated with the construction activity. The permanent and temporary wetland effects would occur primarily in open tidally-influenced channels of the central and south Delta, including Middle River, Victoria Canal and Old River from channel dredging and canal construction. Construction of various operable barriers in major rivers, canals and sloughs throughout the central and south Delta would also contribute to the large acreage affected by water conveyance construction. Most of the construction and dredging activities would not permanently remove the waterways, but would permanently modify the channel bottoms and eliminate any associated aquatic vegetation. An additional effect on waters of the United States is the dredging of 517 acres of tidal flow in Middle River and Victoria and North Canals.

Table 12-9-69. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 9 (acres)

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact
Agricultural Ditch	36.4	8.0	1.0	45.3
Alkaline Wetland	0	0	0	0
Clifton Court Forebay	13.2	0	0	13.2
Conveyance Channel	0.4	0	0	0.4
Depression	4.9	0.1	0	4.9
Emergent Wetland	54.1	9.0	165.0	64.0
Forest	23.5	14.0	60.0	38.0
Lake	0	0	0	0
Scrub-Shrub	5.2	4.0	42.0	9.0
Seasonal Wetland	91.6	28.6		120.2
Tidal Channel	687.0	24.0	401.0	712.0
Vernal Pool	0	0	0	0
Total	**916**	**88**	**669**	**1,674**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

[b] Temporary impacts are due to dredging Delta channels.

The majority of the impacts on wetlands and waters of U.S. are on tidal channels, emergent wetlands, and on wetlands and waters found within cultivated lands (agricultural ditches and seasonal wetlands). These impacts mostly result from dredging work, spoils areas, and canal construction. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that wwould be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the CWA permitting process. The results of this assessment will be compared with the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands would be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Because many impacted wetlands are significantly less than high function, the compensatory mitigation would result in a net increase in wetland function.

Alternative 9 was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures will be implemented, as described in the AMMs set out in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the U.S. are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, will also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing CM4–CM10, some of which could serve the dual purpose of offsetting effects to species and mitigating impacts on waters of the United States, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 9 pursuant to USACE's and EPA's Mitigation Rule (see Section 12.2.1.1). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States,* would be available to address adverse impacts on waters of the United States.

NEPA Effects: The permanent and temporary loss of these jurisdictional wetlands and waters as a result of constructing Alternative 9 water conveyance facilities would be a substantial effect if not compensated by wetland protection and/or restoration. This loss would represent a removal of federally protected wetlands as defined by Section 404 of the CWA. A. Project proponents would implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. However, specific mitigation would be required to ensure that Alternative 9 does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

CEQA Conclusion: The permanent and temporary loss of these jurisdictional wetlands and waters of the United States as a result of constructing Alternative 9 water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 9 does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level. Additionally, Alternative 9 does propose to restore up to 76,721 acres of wetland natural communities under the Plan, which would include 65,000 acres of tidal marsh restoration (CM4), 10,000 acres of seasonally inundated floodplain restoration (CM5), 21 acres of vernal pool/alkali seasonal wetlands (CM9; 67 acres of vernal pool complex and 72 acres of alkali seasonal wetland complex assuming a wetland density of 15%), and 1,700 acres of nontidal marsh restoration (CM10). In addition, Alternative 9 would restore 5,000 acres of riparian habitat (CM7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 20 miles of levees will have channel margin enhancement conducted on them (CM6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees. Impacts on wetlands from CM1 construction would occur in the first 10 years after BDCP approval. Approximately 20,065 acres of this wetland restoration would occur during this time period.

The success in implementing these conservation measures would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP for tidal marsh restoration (BDCP Chapter 3, Section 3.4.4.4), seasonal floodplain restoration (BDCP Section 3.4.5.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 9 would also result in the protection and management of the following natural communities that contain wetlands: 750 acres of valley/foothill riparian, 600 acres of vernal pool complex, 150 acres of alkali seasonal wetland complex, 8,100 acres of managed wetlands, and 50 acres of nontidal marsh. In addition, 8,000 acres of grasslands and 51,625 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Project proponents under Alternative 9 would also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of waters of the United States and any indirect effects on wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 9 does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Other Conservation Measures (CM2–CM10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 9's other conservation measures (CM2–CM10) would alter the acreages and functions and values of wetlands and Waters of the United States in the study area during the course of BDCP conservation action implementation. Because these conservation measures have not been defined to the level of site-specific footprints, it is not possible to delineate and quantify these effects in detail. Several of the conservation measures (CM2, CM4, and CM5) have been described with theoretical footprints for purposes of the effects analysis contained in BDCP Chapter 5, *Effects Analysis*.

Because the wetland delineation was only conducted within the Conveyance Planning Area and not the remainder of the Plan Area, the effects on potential wetlands and waters of the United States from CM2–CM10 were analyzed by looking at effects on wetland natural communities mapped within the theoretical footprints for CM2, CM4, and CM5 by assuming that 100% of the predominantly wetland natural communities listed in Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities*, and that 10% of all of the non-wetland natural communities listed in that table would qualify as wetlands or other waters of the United States under the CWA. Based on this approach approximately 19,850 acres of potentially jurisdictional wetlands and waters could be affected by CM2–CM10. The majority of these impacts are attributable to the conversion of 13,746 acres of managed wetland to tidal marsh under CM4, which would likely result in an improvement of wetland function in the Plan Area.

NEPA Effects: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 9 would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. Although the increase in wetland acreage and wetland functions from these restoration actions could in part offset the effects on waters of the United States in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

CEQA Conclusion: The conversion of existing wetland natural communities to other types of wetland natural communities through implementation of CM2–CM10 for Alternative 9 would be approximately 19,850 acres. Most of these wetlands would be converted to tidal wetlands and open water through implementation of CM4. In total, up to 76,721 acres of wetland natural communities would be restored under Alternative 9. Although the increase in wetland acreage and wetland functions from these restoration could in part offset the effects on waters of the United States occurring in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds. The primary effects of concern for shorebirds and waterfowl are related to the conversion of managed wetland and cultivated lands to tidal marsh associated with habitat restoration. Ducks Unlimited (2013) conducted an analysis to determine the effects of BDCP conservation measures on waterfowl, as well as to determine whether BDCP actions would impede attainment of the goals established by the Central Valley Joint Venture (CVJV) Implementation Plan for the Delta, Yolo, and Suisun Marsh drainage basins. The CVJV efforts are guided by its 2006 Implementation Plan, which is founded on the principles of strategic habitat conservation (Central Valley Joint Venture 2006). Those principles emphasize the establishment of population abundance objectives and the use of species-habitat models to link population objectives to habitat needs. The CVJV has used species-habitat models to translate bird abundance objectives into habitat objectives, while explicitly identifying the biological assumptions that underpin these models and the data used to populate them. As a result, the CVJV's biological planning provides a framework for evaluating the effects of the BDCP on waterfowl.

The Ducks Unlimited waterfowl analysis focused primarily on dabbling ducks. Less than 5% of all geese in the Central Valley occur in the Yolo, Delta, and Suisun Marsh drainage basins. Moreover, geese in the Central Valley rely mostly on agricultural habitats to meet their food energy needs. The BDCP's effect on agricultural habitats is limited to the Delta Basin where about 2500 acres of corn now available to geese would be converted to other habitats (Ducks Unlimited 2013: Table 5). Food supplies for geese would still be well in excess of demand even with the loss of these agricultural habitats (Central Valley Joint Venture 2006, Ducks Unlimited 2013). The duck population objectives used in the analysis were taken directly from the CVJV Plan. Dabbling duck species make up 92% of this objective, while diving duck species make up the remaining 8%. Thus, the results were mostly driven by dabbling duck needs and largely interpreted in the context of dabbling duck foraging ecology. The 55,000 acres of Tidal Natural Communities Restoration (CM4) would be expected to benefit diving ducks by providing deep water foraging habitat. Refer to the Ducks Unlimited Report (Ducks Unlimited 2013) for details of the analysis and methods with respect to the TRUMET model used to quantify effects on food biomass and food quality.

An analysis was conducted to determine the effects of the BDCP covered activities on wintering and breeding shorebird habitat (ICF International 2013). This analysis evaluated the relative increase and decrease in natural communities known to provide important foraging, roosting, and breeding habitat. Similar to the waterfowl analysis, the results were broken up into the three Central Valley Joint Venture Basins that overlap with the BDCP study area: Yolo, Delta, and Suisun. Natural community losses and gains were then translated into species-specific outcomes, comparing the relative habitat value of each BDCP natural community for each Central Valley shorebird species (Table 1, ICF International 2013). The shorebird species ranking system displayed in Table 1 (ICF International 2013) was modified from a table in Stralberg et. al (2011). The table was created using survey data and experts' species-specific habitat rankings. The survey data included fall, winter, and spring density data. This resulted in an overall, cross-season representation of habitat requirements.

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities (CM1) would result in the permanent removal of approximately 3 acres of managed wetland, 6 acres of tidal wetlands, 13 acres of nontidal wetlands, and 2,541 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 83 acres of managed wetland, 6 acres of tidal wetlands, 10 acres of nontidal wetlands, and 899 acres of cultivated lands would be temporarily impacted.

These losses of habitat would occur within the first 10 years of Alternative 9 implementation in the Delta Basin. The BDCP has committed to the near-term protection of 15,400 acres of non-rice cultivated lands, 200 acres of rice, and 700 acres of rice or "rice equivalent" natural communities including nontidal wetlands in the near-term. In addition, 4,100 acres of managed wetlands would be created, protected, and enhanced, 8850 acres of freshwater tidal wetlands would be restored, and 2,000 acres of tidal brackish emergent wetland would be restored (Table 3-4, Chapter 3, *Description of Alternatives*).

Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***NEPA Effects*:** Habitat loss from construction of the Alternative 9 water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse affect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***CEQA Conclusion*:** Habitat loss from construction of the Alternative 9 water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Conservation Components

Suisun Marsh: Managed seasonal wetlands in Suisun Marsh would be reduced by an estimated 8,818 acres as a result of Alternative 9 implementation. This would represent a 25% decrease in managed seasonal wetlands compared with long-term conditions without Alternative 9 (Ducks Unlimited 2013, Table 5). There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the amount of mitigation needed. To address this uncertainty, three levels of food biomass and three levels of nutritional quality were modeled for these existing habitats (Ducks Unlimited 2013, Table 7). Three mitigation scenarios based on these energetic assumptions of biomass and food quality were then run to determine a minimum acreage of managed seasonal wetlands to be protected and enhanced to compensate for the loss of productivity resulting from habitat conversion to tidal wetlands.

- Scenario 1) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 50% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 60% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 5,000 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 2) Assume that the managed seasonal wetlands lost provide medium food biomass and medium food quality. Under this assumption, the managed seasonal wetlands in Suisun Marsh produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, and these seeds have 80% of the metabolizable energy of seeds produced outside of Suisun Marsh. Given the assumption that managed seasonal wetlands in Suisun Marsh could be enhanced to provide high food biomass and high food quality (equal to wetlands in the Central Valley), 13,300 acres of managed wetlands protected and managed for high biomass and high food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.
- Scenario 3) Assume that existing managed seasonal wetlands provide low food biomass and low food quality. Given the assumption that managed seasonal wetlands in Suisun Marsh could only be enhanced to provide medium food biomass and medium food quality (produce 75% of the seed biomass of seasonal wetlands elsewhere in the Central Valley, with these seeds having 80% of the metabolizable energy of seeds produced outside of Suisun Marsh), 8,800 acres of managed wetlands protected and managed for medium biomass and medium food quality would mitigate the conversion of 8,857 acres of managed seasonal wetland to tidal marsh.

The BDCP has committed to protecting and enhancing a minimum of 5,000 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity from habitat conversion to tidal marsh. This minimum commitment of 5,000 acres would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

Yolo and Delta Basins: The replacement of 1,400 acres of managed seasonal wetland with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to have an adverse effect on food productivity, under the assumption that these wetlands would provide adequate food sources. However, a monitoring component and a food study in these tidal habitats would be necessary in order to demonstrate that there would be a less than significant loss of food value in these habitats for wintering waterfowl. If it is determined from monitoring that there in fact would be a significant loss in food productivity resulting from habitat conversion to tidal wetlands, the protection and enhancement of managed wetlands in these watersheds would require mitigation for the change in food biomass and quality. Mitigation Measure *BIO-179b, Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty.

***NEPA Effects*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of effect that Alternative 9 habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 9 to avoid an adverse effect on wintering waterfowl in the Suisun Marsh. Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would be available to address this adverse effect.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity for wintering waterfowl. However, the conclusion that these new wetlands would provide adequate food sources is entirely dependent on assumptions about food production in palustrine tidal habitats. Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would be available to address this uncertainty and avoid an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** There is considerable uncertainty about the biomass and nutritional quality of waterfowl foods produced in Suisun Marsh's managed wetlands, which makes it difficult to identify the level of impact that Alternative 9 habitat loss or conversion would have. The BDCP has committed to protecting and enhancing a minimum of 6,600 acres of managed seasonal wetlands in Suisun Marsh to compensate for the loss of productivity resulting from habitat conversion to tidal marsh. Of this 6,600 acres, at least 5,000 acres would be managed to benefit wintering waterfowl. This minimum commitment of 5,000 acres for wintering waterfowl would mitigate the reduced productivity resulting from conversion of managed seasonal wetlands under the assumptions that 1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food for wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high-quality food. However, the food biomass and productivity in Suisun Marsh would need to be quantified to determine if the 5,000 acres would be sufficient for Alternative 9 to avoid having a significant impact on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Implementation of Mitigation Measure BIO-179a, *Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh*, would address this potential significant impact.

The replacement of 1,400 acres of managed seasonal wetlands with 19,000 acres of palustrine tidal wetlands in the Delta watershed, and the replacement of 600 acres of managed seasonal wetlands with 2,000 acres of palustrine tidal wetlands in the Yolo watershed would not be expected to alter food productivity. However, the conclusion that these tidal wetlands would provide adequate food sources for wintering waterfowl is entirely dependent on assumptions about food production in palustrine tidal habitats. Studies of food biomass and food quality in palustrine tidal habitats are needed to confirm that no mitigation for wintering waterfowl would be required in the Yolo and Delta Basins. Implementation of Mitigation Measure BIO-179b, *Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins*, would address this uncertainty and would reduce this impact on wintering waterfowl to a less-than-significant level.

Mitigation Measure BIO-179a: Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh

Poorly managed wetlands (considered low biomass and food quality) will be identified and managed by BDCP proponents to improve food quality and biomass. Studies will be required to quantify 1) food production of existing managed wetlands in Suisun Marsh and 2) energetic productivity of brackish and tidal marsh habitats. Protected wetlands will be monitored to measure changes in the energetic productivity of these sites. Based on the food studies and monitoring results, BDCP proponents will determine if the minimum commitment of 5,000 acres is sufficient to meet the goal of 1:1 compensation for loss of wintering waterfowl habitat with the protection and management of managed wetlands in perpetuity. If monitoring demonstrates that additional acreage is needed to meet this goal, additional acreage of protection or creation of managed wetlands and management will be required.

Mitigation Measure BIO-179b: Conduct Food Studies and Monitoring to Demonstrate Food Quality of Palustrine Tidal Wetlands in the Yolo and Delta Basins

In order to address the uncertainty of the impact of loss of managed wetlands in the Yolo and Delta Basins on wintering waterfowl, BDCP proponents will conduct food studies and monitoring to demonstrate the food quality of palustrine tidal habitats in these basins. If studies show that the assumption of no effect was inaccurate, and the food quality goal of 1:1 compensation for wintering waterfowl food value is not met, additional acreage of protection or creation of managed wetland and management will be required.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Conservation Components

Alternative 9 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 9 would reduce semipermanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. While a reduction in these semipermanent habitats would represent a habitat loss for breeding waterfowl, with the restoration of 24,000 acres of palustrine tidal wetlands (Table 3-4, Chapter 3, *Description of Alternatives*) in the Yolo and Delta basins there would be a less than adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (i.e., March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to the BDCP.

Suisun Marsh: Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres from the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared to seasonally managed habitats (Central Valley Joint Venture 2006).

The BDCP includes a commitment to protect and enhance 1,600 acres of permanently flooded managed wetlands in Suisun Marsh to provide habitat for breeding waterfowl. In addition, 5,000 acres of semipermanent wetlands that would be protected and enhanced for wintering and migratory waterfowl (Table 3-4, Chapter 3; BDCP Chapter 3, *Conservation Strategy*, Objective MWNC1.1,).

Food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. These studies would be needed in order to quantify impacts on breeding waterfowl in Suisun Marsh and to determine not only the number of acres that would compensate for loss of breeding habitat at a ratio of 1:1 for habitat value, but how those acres should be managed. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of this effect.

In addition to providing semipermanent wetlands to breeding waterfowl, the Suisun Marsh contains several key upland areas that have significant nesting value. The largest block of upland habitat in the region is the core area on the Grizzly Island Wildlife Area. This area does not overlap with the hypothetical footprint for *CM4 Tidal Natural Communities Restoration*. However, this core area includes over 2,000 acres of upland grasslands that have some of the highest duck nesting densities in California (Central Valley Joint Venture 2006). A few small wetland areas are scattered within this core grassland mosaic that provide necessary freshwater brooding habitat. If restoration footprints were changed during the implementation process of BDCP to overlap with this area, the effects on breeding waterfowl would likely be greatly increased.

NEPA Effects: Alternative 9 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 9 would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203 acres, respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 9 would not have an adverse effect on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 9 implementation. Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but such management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss of breeding waterfowl habitat resulting from implementation of Alternative 9 could have an adverse effect. Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would be available to address the uncertainty of model assumptions and the potential adverse effect of habitat conversion on breeding waterfowl in Suisun Marsh.

CEQA Conclusion: Alternative 9 would reduce managed wetlands in the Yolo and Delta basins by 437 acres and 1,155 acres, respectively. Under the assumption that 15% of these wetlands are managed as semi-permanent wetlands, Alternative 9 would reduce semi-permanent wetlands in the Yolo and Delta drainage basins by 77 acres and 203, acres respectively. The reduction in these semi-permanent habitats would represent a habitat loss for breeding waterfowl. However, with the restoration of 24,000 acres of palustrine tidal wetlands in the Yolo and Delta basins, Alternative 9 would have a less-than-significant impact on breeding waterfowl. These palustrine habitats would presumably contain water during the breeding period (March through July), and would be expected to compensate for the loss of 280 acres of managed semi-permanent wetlands in the Yolo and Delta watersheds attributed to Alternative 9.

Total managed wetlands in Suisun Marsh would decline from 41,012 acres to 30,640 acres with the conversion of managed seasonal and semi-permanent wetlands to tidal habitats. Some of the remaining seasonal wetlands could be managed as semi-permanent wetlands to offset the loss of breeding habitat, but this management could further reduce food supplies available to wintering waterfowl under the assumption that semi-permanent wetlands provide few food resources compared with seasonally managed habitats. The protection and enhancement of 1,600 acres of permanently flooded managed wetlands would provide habitat for breeding waterfowl. However, food studies and monitoring would be necessary to determine how increases in tidal marsh and salinity levels would affect the overall reproductive capacity of the marsh. Therefore, the loss or conversion of habitat from implementation of Alternative 9 could have a significant impact on breeding waterfowl in Suisun Marsh. Implementation of Mitigation Measure BIO-180, *Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh*, would address the uncertainty of model assumptions and reduce the impact to a less-than-significant level.

Mitigation Measure BIO-180: Conduct Food and Monitoring Studies of Breeding Waterfowl in Suisun Marsh

To address the uncertainty of the impact of loss of managed wetlands in Suisun Marsh on breeding waterfowl, BDCP proponents will conduct food studies and monitoring to determine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the marsh.

The required studies will examine how increases in tidal marsh and salinity levels will affect the overall reproductive capacity of the Marsh. Reproductive studies will address but will not be limited to the following questions:

- How does the distribution of breeding waterfowl in Suisun Marsh differ in tidal versus managed habitats and across salinity gradients?
- How does waterfowl nest success and nest density vary with respect to tidal versus managed habitats and across salinity gradients?
- What are the patterns of habitat selection and movements by waterfowl broods in relation to tidal vs. managed habitats, and are there impacts on duckling survival?
- What is the current relationship between waterfowl reproductive success and interactions with alternate prey and predators, and how is tidal restoration likely to alter these relationships?

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

Yolo Basin: Primarily as a result of *CM4 Tidal Natural Communities Restoration* within the Yolo Basin, 1,185 acres of managed wetland habitat would be permanently converted; 1,066 acres of which are protected. In addition, 42 acres of managed wetland habitat would be temporarily lost by construction-related activities associated with tidal restoration (CM4) and Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could periodically affect managed wetlands ranging from an estimated 643 acres during a notch flow of 1,000 cfs to an estimated 2,055 acres during a notch flow of 4,000 cfs Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*) in the Yolo Basin.

Delta Basin: Within the Delta Basin, 90 acres of managed wetland habitat would be permanently converted, as a result of tidal restoration (CM4). Thirteen of the 90 acres are protected (Table 3, ICF International 2013). Periodic flooding would not affect this natural community type in Delta Basin.

Suisun Basin: Within the Suisun Basin, 11,532 acres of managed wetland habitat would be permanently converted as a result of tidal restoration (CM4); 10,354 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (Charadrius semipalmatus), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

Managed wetlands would decrease in overall extent by 20% (Table 5, ICF International 2013). Most of this loss would occur in Suisun with some additional acreage loss in the Yolo Basin. The loss of managed wetland habitat for covered species and waterfowl would be compensated for with 8,200 acres remaining managed wetland protection in Suisun Marsh. Of these 8,200 acres, the 5,000 acres of seasonal wetland protected, enhanced, and managed to provide overwintering waterfowl foraging habitat would be the habitat type most likely to benefit overwintering shorebirds. However, the 1,600 acres of semi-permanent and permanent managed wetlands for breeding waterfowl and 1,500 acres of managed wetlands for salt marsh harvest mouse would also be expected to have some benefit to wintering and breeding shorebirds.

Cultivated Lands

Yolo Basin: Primarily as a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 8,309 acres of cultivated lands would be permanently converted; 1,272 acres of which are protected. Also within the Yolo Basin, increased inundation frequency, depth and duration associated with the ongoing operation of a modified Fremont Weir (CM2) could affect an estimated 3,219 acres of cultivated lands during a notch flow of 1,000 cfs to an estimated 5,512 acres during a notch flow of 6,000 cfs (Table 5.4-2, in BDCP Chapter 5, *Effects Analysis*)

Delta Basin: Within the Delta Basin, as a result of tidal restoration (CM4) and floodplain restoration (CM5), 25,633 acres of cultivated lands would be permanently converted. There would also be an additional 112 acres lost temporarily due to CM5 activities. Of the total permanently converted lands, 3,925 acres are protected (Table 3, ICF International 2013). Seasonal flooding (CM5) on the restored floodplain would periodically affect 738 acres of cultivated lands in Delta.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Cultivated land loss would occur in all three basins, but the majority of acreage loss would occur in the Delta basin. Pasture crop types would decrease in overall extent by 15% over baseline (Table 5, ICF International 2013), but would increase in protection by 135%. More than half of all cultivated lands within the 48,000-acre BDCP cultivated lands reserve would be in pasture production (primarily alfalfa) and enhanced and managed to benefit Swainson's hawk. Idle crop types are not identified as a specific conservation target in the BDCP, are expected to occur within the reserve and are recognized in the BDCP as having "moderate" foraging habitat value for Swainson's hawk, white-tailed kite, and greater sandhill crane.

Grain and hay crop would be expected to decrease by 13% (Table 5, ICF International 2013) while protection, enhancement and management would be expected to increase by 28% (Table 6, ICF International 2013). These crop types would be managed for a tricolored blackbirds, Swainson's hawk, white-tailed kite, greater sandhill crane, and burrowing owls.

Rice would decrease in overall extent by 2% (Table 5, ICF International 2013) but increase in total protection by 57%. Rice lands would be protected, enhanced, and managed for the benefit for giant garter snake.

Tidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 194 acres of tidal wetland habitat would be permanently converted; 180 acres of which are protected. In addition, 12 acres of tidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass would affect 3,957 acres of tidal wetlands in Yolo Basin.

Delta Basin: Within the Delta Basin, 54 acres of tidal wetlands would be permanently converted as a result of tidal restoration (CM4) (Table 3, ICF International 2013). Of the total permanently converted lands, 26 acres are protected. Periodic flooding in Yolo Bypass would affect 26 acres of tidal wetlands in Delta Basin.

Suisun Basin: Within the Suisun Basin, 219 acres of tidal wetland habitat would be permanently converted as a result of tidal restoration (CM4); 215 of which are protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

Tidal mudflat habitat would be estimated to increase in extent by 1,780 acres. This extremely large increase in tidal mudflat habitat would occur almost exclusively in Suisun Marsh as the result of tidal restoration and the conversion of existing mid- and high-marsh types to low marsh and tidal mudflats in response to sea level rise. BDCP Appendix 3.B, *BDCP Tidal Habitat Evolution Assessment*, details the methods and assumptions modeled to come about this result. Tidal mudflat habitats would be expected to require management, however, sediment augmentation has been discussed as an experimental method that could be employed in places like Suisun to combat the loss of intertidal marshes in the face of sea level rise and reduced sediment supplies.

Tidal emergent wetland habitat would increase in extent by 152% (Table 5, ICF International 2013). Of the 30,000 acres of emergent wetland restoration, 6,000 acres would be in the Suisun Basin and the rest would be distributed between the Yolo and Delta Basins. Enhancement and management on these lands would be likely to be focused on nonnative, invasive species management. Any additional actions in Suisun would be focused on salt marsh harvest mouse, Suisun shrew, California clapper rail, black rail, Suisun thistle, and soft bird's-beak. In freshwater marshes, enhancement and management would be likely to focus on black rail, western pond turtle, and, in some cases, giant garter snake.

Nontidal Wetlands

Yolo Basin: As a result of tidal restoration (CM4) and Fisheries Enhancement activities (CM2) within the Yolo Basin, 313 acres of nontidal wetland habitat would be permanently converted; 119 acres of which are protected. In addition, 11 acres of nontidal wetland habitat would be temporarily lost by construction-related activities associated with Fisheries Enhancement activities (CM2) (Table 2, ICF International 2013). Periodic flooding in Yolo Bypass associated with ongoing Fremont Weir operation (CM2) would affect 305 acres of nontidal wetlands in Yolo Basin, specifically nontidal perennial aquatic habitat.

Delta Basin: Within the Delta Basin, 99 acres of nontidal wetlands would be permanently converted as a result of tidal restoration (CM4) and floodplain restoration (CM5) (Table 3, ICF International 2013). There would also be 8 acres of nontidal perennial aquatic habitat temporarily lost from CM5 activities. Of the total permanently converted lands, 29 acres are protected. Periodic flooding from CM5 would affect 4 acres of nontidal perennial aquatic habitat in Delta Basin.

Suisun Basin: Within the Suisun Basin, 1 acre of nontidal wetland habitat, specifically vernal pool complex, would be permanently converted as a result of tidal restoration (CM4); and is not protected. (Table 4, ICF International 2013). Periodic flooding would not affect this natural community type in Suisun Basin.

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

Nontidal freshwater emergent wetland would increase in extent by 88% as a result of BDCP implementation (Table 5, ICF International 2013). These lands would be managed to benefit giant garter snake and located within the Delta Basin (likely in the vicinity of White Slough) and the Yolo Basin (in the Cache Slough area).

Impacts on wetted acres of vernal pool complex and alkali seasonal wetland complex would be avoided and thus loss of this community is not expected. However, up to 10 acres of wetted acre loss could be permitted under the Plan. Protection of vernal pool complex natural community would increase by 13% and by 6% for alkali seasonal wetlands (Table 6, ICF International 2013). Protection of these two community types would enhance and manage habitat for vernal pool crustaceans and alkali-related plant species.

The protection and restoration of natural communities would also include management and enhancement actions under *CM11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under CM11 in areas where they would not conflict with covered species management.

- Managed Wetlands
  - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
  - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
  - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
  - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
  - Create low slopes on islands and levees; gradual angles (10–12:1) are better than steep angles.
  - Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
  - Potentially add material to levees or to islands to encourage nesting for some species.
- Cultivated Lands
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July–September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
  - Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded

for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds) (ICF International 2013).

- Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
- Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
- When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
- Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
- Maintain gently sloping levees and island sides (10–12:1; Iglecia et al. 2012).
- Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

NEPA Effects**:** Alternative 9 implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be substantial loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While substantial losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for the loss of substantial acreage, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

CEQA Conclusion**:** Alternative 9 implementation would result in the conversion of managed wetland and cultivated lands to tidal natural communities, including tidal mudflat. The result would be significant loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While significant losses of cultivated lands would be incurred, protection, enhancement, and management of the remaining acres would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these types are being driven by covered species, these management actions would also benefit shorebirds. The protection, enhancement, and management of remaining managed wetlands in Suisun Marsh, in compensation for substantial acreage loss, would have some incremental benefits for shorebirds, but would be unlikely to compensate for the overall loss. However, with the protection and restoration of acres in the Delta and Yolo watersheds, in addition to the implementation of the management actions outlined in *CM11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other conservation actions. However, transmission lines constructed under Alternative 9 would be temporary and would be removed after the completion of CM1 construction activities (within the first 10 years of Plan implementation). In addition, implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight diverters on new transmission lines, and selected existing transmission lines in the study area.

***NEPA Effects*:** New transmission lines would increase the risk for shorebird and waterfowl power line strikes. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

***CEQA Conclusion*:** New transmission lines would increase the risk for shorebird and waterfowl power line strikes. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008).

Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of mercury (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect shorebirds and waterfowl, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

In addition, the potential mobilization or creation of methylmercury within the Plan Area varies with site-specific conditions and would need to be assessed at the project level. *CM12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in CM12 would be available to address the uncertainty of methylmercury levels in restored tidal marsh and potential impacts on shorebirds and waterfowl.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, BDCP restoration activities that create newly inundated areas could increase bioavailability of selenium (see BDCP Chapter 3, *Conservation Strategy*, for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, CM1 would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related conservation measures (CM4–CM5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of Alternative 9 water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 9 implementation would not have an adverse effect on shorebirds and waterfowl. Tidal habitat restoration is unlikely to have an adverse effect on shorebirds and waterfowl through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds, and the potential for increased exposure would vary substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *CM12 Methylmercury Management*, would address the uncertainty of methylmercury levels in restored tidal marsh. Once site-specific sampling and other information is developed, the site-specific planning phase of marsh restoration would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury.

CEQA Conclusion: Noise, potential hazardous spills, and increased dust and sedimentation as a result of Alternative 9 water conveyance facilities construction and operation and maintenance would have a significant impact on shorebirds and waterfowl. AMM1–AMM7 would minimize these impacts, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce the impacts to a less-than-significant level. Tidal habitat restoration is unlikely to have a significant impact on shorebirds and waterfowl species through increased exposure to methylmercury, as these species currently nest and forage in tidal marshes with elevated methylmercury levels. However, it is unknown what concentrations of methylmercury are harmful to species of waterfowl and shorebirds. Site-specific restoration plans that address the creation and mobilization of mercury, as well as the monitoring and adaptive management described in CM12, would be the appropriate place to assess the potential risk of shorebird and waterfowl exposure to methylmercury in the study area. Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects of Alternative 9 implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not covered under laws or regulations that address conservation or protection of individual species. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in the analysis of Alternative 9 effects on natural communities. In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the Plan over a 50-year time period, several natural communities and land cover types would be reduced in size, primarily from restoration of other natural communities. Grassland, managed wetland and cultivated lands would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement and management actions contained in the BDCP, including *CM3 Natural Communities Protection and Restoration*, *CM4 Tidal Natural Communities Restoration*, *CM5 Seasonally Inundated Floodplain Restoration*, *CM6 Channel Margin Enhancement*, *CM7 Riparian Natural Community Restoration*, *CM8 Grassland Natural Community Restoration*, *CM9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *CM10 Nontidal Marsh Restoration*, and *CM11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing Alternative 9 conservation measures would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife. Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants).

NEPA Effects: The direct and indirect effects associated with implementing the conservation measures of Alternative 9 would not be adverse because the conservation measures and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

CEQA Conclusion**:** Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Conservation measures to avoid or minimize effects on special-status species, to prevent the introduction and spread of invasive species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of the BDCP is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

ECAs are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the Plan Area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effect of BDCP Conservation Measures on Wildlife Corridors

Alternative 9 would have conveyance facility construction occurring within the Mandeville Island-Staten Island ECA. The conveyance facility construction would also occur along two linkages identified in the BDCP, the *Middle River* linkage (#6 in Figure 12-2) and the *White Slough to Stone Lakes* linkage (#11 in Figure 12-2).

The construction of an operable barrier and associated transmission lines would occur on the northwestern tip of Mandeville Island. These facilities would not create a substantial barrier to wildlife movement within and outside of this ECA. The construction of transmission lines may result in localized impacts on sandhill cranes and other avian species during periods of low visibility, but these transmission lines are relatively short and would not substantially affect flight patterns.

The Alternative 9 dredge spoils areas and an operable barrier identified along Middle River (linkage #6) would greatly conflict with the BDCP's plan for riparian conservation and establishing riparian connectivity along this stretch of Middle River. The dredge disposal areas could make a substantial section of Middle River unsuitable for BDCP riparian conservation actions.

The construction of a transmission line across BDCP the *White Slough to Stone Lakes* linkage would not substantially conflict with the BDCP's plans for giant garter snake conservation along this corridor.

Restoration activities would be implemented in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

NEPA Effects**:** Alternative 9 would conflict with the BDCP's planned riparian conservation along Middle River; however, compared to No Action this alternative would not result in adverse effects on wildlife corridors.

CEQA Conclusion**:**

The construction of an operable barrier and associated transmission lines would occur on the northwestern tip of Mandeville Island. These facilities would not create a substantial barrier to wildlife movement within and outside of the Mandevill Island-Staten Island ECA. The construction of transmission lines may result in localized impacts on sandhill cranes and other avian species during periods of low visibility, but these transmission lines are relatively short and would not substantially affect flight patterns.

The Alternative 9 dredge spoils areas and an operable barrier identified along Middle River (linkage #6) would greatly conflict with the BDCP's plan for riparian conservation and establishing riparian connectivity along this stretch of Middle River. The dredge disposal areas could make a substantial section of Middle River unsuitable for BDCP riparian conservation actions.

The construction of a transmission line across BDCP the *White Slough to Stone Lakes* linkage would not substantially conflict with the BDCP's plans for giant garter snake conservation along this corridor.

Restoration activities would be implemented in the ECAs within Yolo Bypass (*CM2 Yolo Bypass Fisheries Enhancement*) and within the Grizzly Island-Lake Marie ECA (*CM4 Tidal Natural Communities Restoration*). These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (CM3) and the enhancement and management of these areas (CM11) would improve and maintain wildlife corridors within the study area.

Alternative 9 would conflict with the BDCP's planned riparian conservation along Middle River; however, under the Existing Conditions, this alternative would overall result in less-than-significant impacts on wildlife corridors.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities covered under the BDCP could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of Alternative 9 are listed here.

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.

- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from four activities.

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, reusable tunnel material, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-9-70 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 9 of the BDCP.

Table 12-9-70. Summary of Temporary Disturbance in Natural Communities under Alternative 9

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	360
Tidal brackish emergent wetland	0
Tidal freshwater emergent wetland	123
Valley foothill riparian	367
Grassland	590
Inland dune scrub	0
Alkali seasonal wetland complex	0
Vernal pool complex	0
Other natural seasonal wetland	0
Nontidal freshwater perennial emergent wetland	25
Nontidal perennial aquatic	27
Managed wetlands	65
Agricultural lands	1,959
Total	**3,516**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Under Alternative 9, the BDCP would have adverse effects on natural communities from the introduction and spread of invasive plant species through implementation of CM1–CM10 and AMM6. No adverse effects are expected from implementation of CM11–CM21.

- *CM1 Water Facilities and Operation*: Construction of the Alternative 9 water conveyance facilities would result in the temporary disturbance of 3,507 acres that would provide opportunities for colonization by invasive plant species.
- *CM2 Yolo Bypass Fisheries Enhancement*: Construction of the Yolo Bypass fisheries enhancements would result in the temporary disturbance of 758 acres that would provide opportunities for colonization by invasive plant species. Vegetation maintenance activities for the Fremont Weir and Yolo Bypass improvements may include the removal of giant reed; however, the clearing of linear areas to facilitate water flow may also result increased opportunities for invasion. Sediment removal, transportation, and application as a source material for restoration or levee projects as part of Fremont Weir and Yolo Bypass maintenance activities could also result in the spread of invasives if the sediment contains viable invasive plant propagules.
- *CM3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in the eleven CZs would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *CM4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the BDCP Implementation Office would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the BDCP Implementation Office would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *CM5 Seasonally Inundated Floodplain Restoration*: Floodplain restoration levee construction would result in the temporary disturbance of 1,285 acres along channels in the north, east, and south Delta (San Joaquin, Old, and Middle Rivers) that would provide opportunities for colonization by invasive plant species.
- *CM6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.

- *CM7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *CM8 Grassland Natural Community Restoration*: The restoration of grassland habitat in CZs 1, 8 and/or 11 would result in the temporary disturbance of degraded grassland or cultivated land that would provide opportunities for colonization by invasive plant species.
- *CM9 Vernal Pool and Alkali Season Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes in CZs 1, 8, or 11 would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *CM10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of agricultural lands in CZs 2 and 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.
- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoils, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of CM11, AMM4 AMM10 and AMM11.

CM11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the BDCP reserve system to reduce competition on native species, thereby improving conditions for covered species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10, and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would include the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would involve methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the BDCP Implementation Office would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed of to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the other conservation measures, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any BDCP restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the study area. Cleaning stations would be established at the perimeter of BDCP covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

***NEPA Effects*:** The implementation of AMM4, AMM10, AMM11, and CM11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

***CEQA Conclusion*:** Under Alternative 9, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing the BDCP would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Conservation Measures with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities (CM1) and implementing CM2–CM21 for Alternative 9 have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 9 would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 9 on terrestrial biological resources are addressed in the impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the BDCP. Federal and State Legislation

- The federal *Clean Water Act*, *Endangered Species Act*, *Fish and Wildlife Coordination Act*, *Migratory Bird Treaty Act*, *Rivers and Harbors Act* and *Marine Mammal Protection Act* all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decision making. The biological goals and objectives contained in the BDCP that provide the major guidance for implementing the various conservation elements of Alternative 9 are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the study area. While some of the conservation measures of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term guidance in the Plan would provide for the long-term viability and expansion of the habitats and special-status species populations in the study area. Alternative 9 conservation actions would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.

- The *California Endangered Species Act*, *California Native Plant Protection Act*, *Porter-Cologne Water Quality Control Act*, and *Natural Communities Conservation Planning Act* are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. The BDCP, which is the basis for Alternative 9, contains biological goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 9 conservation actions would be compatible with the policies and directives contained in these laws.

- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are BDCP proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The BDCP biological goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).

- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. The BDCP and its plans for protection and restoration of tidal marsh habitats in Suisun Marsh would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the

Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The BDCP is intended to become a component of the Delta Plan. The Delta Stewardship Council would determine whether the BDCP is compatible with the goals and objectives of the Delta Plan prior to its incorporation into the Plan. The compatibility of the BDCP with the Delta Plan is considered in detail in Section 13.2.2.2 of Chapter 13, *Land Use*.

- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. Alternative 9 conservation measures that provide for a significant expansion of wetland acreage and quality in the Delta and Suisun Marsh are compatible with the intent of the California Wetlands Conservation Policy.

- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The BDCP Plan Area includes all or portions of three Implementation Plan basins—the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

  Implementation of the Alternative 9 conservation measures would result in significant reductions in cultivated land and managed wetland acreage in the Delta, Yolo and Suisun basins; however, significant increases in tidal and nontidal wetlands in these basins would be another result. Because of the large conversion of managed wetland in the Suisun basin, the BDCP has included a large managed wetland conservation and enhancement goal for this area. For the Suisun basin conversions to be compatible with the 2006 Implementation Plan goals, this EIR/EIS has added mitigation that would require food production studies and adaptive management to ensure that the Suisun basin would continue to provide the waterfowl and shorebird habitat envisioned in the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, *Yolo Bypass Wildlife Area Land Management Plan*, *Grizzly Island Wildlife Area Management Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 9, especially construction of CM1 and CM2 facilities, and land modification associated with CM4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the BDCP would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Yolo Bypass, on Sherman Island, and in Suisun Marsh would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. The SMPA was signed in 1987 and modified in 2005 by DWR, CDFW, Reclamation and the Suisun Resource Conservation District to establish the mitigation approach in the Marsh for effects of operating the SWP and CVP. The primary concerns were the effects of CVP and SWP Delta diversions on salinity in the Marsh. The SMPA focused on ways to ensure adequate water quality and quantity for the managed wetlands and wildlife habitats in the Marsh to assure equal waterfowl values in the Marsh. The Suisun Marsh Plan, for which a Final EIS/EIR was released in 2010 by these agencies, provides for restoration of tidal marsh habitat and enhancement of managed wetland in the Marsh, maintenance of waterfowl hunting and recreational opportunities in the Marsh, maintenance and improvement of the Marsh levee system, and protection and enhancement of water quality for beneficial uses of the Marsh. An integral component of the Suisun Marsh Plan is balancing continued managed wetland operation with new tidal wetland restoration to provide improved and greater habitat for fish and wildlife species. The Suisun Marsh Plan is a programmatic, long-term plan and does not include specific projects, project proponents, or funding mechanisms. However, the Suisun Marsh Plan relies on tidal restoration to allow for managed wetland operations to continue. The BDCP would provide a funding mechanism and increased management potential relative to existing and restored habitats, assisting the Suisun Marsh Plan in meeting its broader ecological goals, consistent with long-term operation of the SWP and CVP water conveyance facilities. The conservation actions contained in the BDCP, which are designed to ensure the long-term protection and recovery of special-status fish and wildlife species dependent on the Marsh, would be compatible with the water quality and habitat restoration goals of the SMPA and Suisun Marsh Plan.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the Plan's long-term control and management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that Plan objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of BDCP's conservation actions would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 9 would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans* and *Natural Community Conservation Plans* are the subject of a detailed analysis at the end of this chapter. The analysis considers the compatibility of the BDCP with all HCPs and NCCPs that share planning area with the BDCP Plan Area.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The BDCP proposes to protect, enhance and expand the wetlands of the Plan Area, and, therefore, would be compatible with Executive Order 11990.
- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 9 construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of mitigation measures described in this chapter would be capable of making Alternative 9 implementation compatible with Executive Order 13112.
- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 9 conservation measures that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion conservation measures of Alternative 9 would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

CEQA Conclusion: The potential plan and policy incompatibilities of implementing Alternative 9 identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of large acreages of cultivated land and managed wetland to natural wetland and riparian habitat in the Plan Area. The physical effects are discussed in the Shorebirds and Waterfowl analysis above and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2.3 of Chapter 13, *Land Use*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations and the relationship between plan and policy consistency and physical consequences to the environment.

12.3.4 Effects and Mitigation Approaches—Alternatives 4A, 2D, and 5A

12.3.4.1 No Action Alternative Early Long-Term

Effects of the No Action Alternative (ELT) as considered for the purposes of Alternative 4A, 2D, and 5A would be similar to the effects described for the No Action Alternative (LLT), except that the shorter timeframe would reduce the effects of many projects and programs listed in Table 12-7 in Section 12.3.3.1. The reduced timeframe would also lessen the potential effects of sea level rise and would reduce, but not eliminate, the risks to biological resources from flood- or seismic-related failure of Delta levees.

Implementation of the ongoing habitat expansion projects is likely to show significant progress in the ELT time period as efforts are made to counteract the terrestrial habitat losses associated with land conversion (primarily agricultural) and urban and infrastructure development in a timely fashion. These habitat expansions would be expected to counteract any transportation- or water-related infrastructure development or urban development in the study area because of the tight controls on these developments in the Delta. Management of the state and federal wildlife areas and the private wetlands would continue to emphasize a balance of protection for sensitive plant and wildlife species and the need for recreation opportunities and long-term agricultural viability. The number of habitat enhancement projects and the acreage of natural habitats restored and protected would likely be lower than what would be expected over a 50-year timeframe. Ongoing water management activities under the No Action Alternative (ELT) would not be likely to substantially modify the natural communities of the study area during the ELT time period. Most water management strategies being developed by state and federal water management agencies are designed to improve the conditions for special-status fish, wildlife, and plants in the study area.

The potential for adverse effects on biological resources from gradual sea level rise and from levee system failures due to major flooding episodes or seismic activity would be significantly reduced under No Action Alternative (ELT), compared with the 50-year timeframe under No Action Alternative (LLT). The extent of marsh habitat conversion would be lessened on the periphery of Suisun Marsh and the Yolo Basin, and along the Delta waterways, with a lower rise in sea level. The risk of habitat destruction from levee failure and subsequent flooding of riparian and cropland areas on Delta islands due to major flood events or seismic shaking would be reduced in the ELT. However, over the long-term, the risk would remain that major areas of cropland and adjacent natural habitats could be lost due to the poor condition of many Delta levees.

NEPA Effects: Even though the No Action Alternative (ELT) time period is significantly reduced from the No Action Alternative (LLT) time period, the overall direction of existing and ongoing programs and policies that influence land conversion and land management in the study area would continue to be toward maintaining the mix of agricultural, recreational, water management, and wildlife uses in the Delta, Yolo Bypass, and Suisun Marsh. Some actions under the No Action Alternative (ELT) will expand natural and manmade terrestrial and wetland habitats that will either benefit or have no effect on the special-status and common plants and wildlife in the study area. These activities may also result in impacts on some species but the overall benefit of these activities would not be adverse for many species by the ELT time period (see Table ES-8 in the *Executive Summary*). The potential will remain, however, for long-term trends in levee deterioration, global climate change, and seismic activity that could damage levees and result in significant changes in natural communities and cultivated lands.

CEQA Conclusion: Under the No Action Alternative (ELT) existing plans, programs and policies would affect terrestrial biological resources in the study area in a mostly positive way. Risks associated with natural processes that could damage or destroy Delta levees that protect both natural habitats and agricultural lands will continue, only over a shorter time period than under the No Action Alternative (LLT). The risks include flood-related levee deterioration, potential for seismically induced levee collapse, and, to a lesser extent, sea level rise associated with climate change. These risks, even over the shorter time period, if unchecked, could result in a net reduction in sensitive natural communities and special-status species. Many plans and programs call for expanded development and management of wetland and riparian habitats and increased management of cultivated lands for joint benefit to the farmer and wildlife. The implementation of these plans and programs would also likely impact some terrestrial biological resources, although on balance these impacts would be offset by habitat improvements and would result in less-than-significant impacts under CEQA by the ELT time period (see Table ES-8 in the *Executive Summary*). For some species, especially those that occur in the study area at higher elevations, there may be no impact from these plans and programs.

12.3.4.2 Alternative 4A—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance, and management associated with the implementation of Alternative 4A would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal or modification of this community (see Table 12-4A-1). A small amount of this community could also be lost to channel margin habitat enhancement (Environmental Commitment 6).

Table 12-4A-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	280	2,019[b]
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**280**	**2,019**

[a] See discussion below for a description of applicable Environmental Commitments.
[b] The large acreage of tidal perennial aquatic habitat affected by Alternative 4A is related primarily to dredging of Clifton Court Forebay; the habitat would not be permanently removed, it would be expanded.

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities for Alternative 4A would permanently affect an estimated 280 acres and temporarily remove 2,019 acres of tidal perennial aquatic natural community in the study area. The large temporary loss of this natural community would be primarily related to dredging of Clifton Court Forebay (1,931 acres). These modifications represent less than 3% of the 86,263 acres of the community that is mapped in the study area. The permanent and temporary effects would occur during the construction period for Alternative 4A as water conveyance facilities are developed. An undetermined amount of this natural community could also be affected by channel margin habitat enhancement along the major Delta waterways. The 450-acre expansion of Clifton Court Forebay during the water conveyance facility construction would offset the permanent losses.

The effects of water conveyance facilities and Environmental Commitment 6 are addressed below. A summary statement of impacts and NEPA and CEQA conclusions follows the individual environmental commitment discussion.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 280 acres and temporarily disturb 2,019 acres of tidal perennial aquatic community. Most of the permanent loss would occur where new facilities are constructed at Clifton Court Forebay and where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland (see the Terrestrial Biology Mapbook for a detailed view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay, where Clifton Court Forebay levees are modified.
- The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest effect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at four locations along the tunnel route. The barge unloading construction would temporarily affect Snodgrass Slough just south of Hood, Potato Slough at the south end of Boldin Island, Venice Reach of the San Joaquin River at the south end of Venice Island, Connection Slough at the north end of Bacon Island, and Old River just south of its junction with North Victoria Canal. In addition, temporary transmission lines have been identified as resulting in temporary impacts; however, these areas will likely ultimately be avoided by spanning these areas of open water. The details of these locations can be seen in the Terrestrial Biology Mapbook. These losses would take place during the 14-year construction time period.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would be implemented on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements could be implemented on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the effects discussed above and describe other project actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the first 14 years of Alternative 4A implementation, the project would affect the tidal perennial aquatic community through water conveyance facilities construction losses (280 acres permanent and 2,019 acres temporary). These losses would occur primarily at Clifton Court Forebay due to dredging, and along the Sacramento River at intake sites.

NEPA Conclusion: The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A environmental commitments. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The largest loss would occur at Clifton Court Forebay, and would be temporary. This tidal perennial habitat is of relatively low value to special-status terrestrial species in the study area. The permanent expansion of the Clifton Court Forebay aquatic habitat (approximately 450 acres) during the first 14 years of Alternative 4A implementation would offset the permanent loss; the restoration of Clifton Court

Forebay aquatic habitat following construction-related dredging would offset the temporary project effects. These actions would avoid any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 2,299 acres of restoration would be needed to offset (i.e., mitigate) the 2,299 acres of effect (the total permanent and temporary effects listed in Table 12-4A-1) associated with water conveyance facilities construction; however, as noted above, 1,931 acres of the temporary impacts are associated with the dredging within the existing Clifton Court Forebay. The forebay is an enclosed system that would prevent suspended sediments from spreading outside of the area of disturbance, and the forebay would essentially revert back to pre-project conditions once dredging is complete.

The alternative also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Therefore, changes in tidal perennial aquatic natural community as a result of implementing Alternative 4A would not be adverse.

***CEQA Conclusion*:** Alternative 4A would result in the loss, conversion, and temporary disturbance of approximately 2,299 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities. The construction losses would occur primarily at Clifton Court Forebay, along the Sacramento River at intake sites, and along various Delta waterways at barge offloading sites. The losses,conversions, and disturbance would be spread across the 14-year water conveyance facilities construction period. These effects would be offset by planned restoration and expansion of Clifton Court Forebay (a combined acreage of approximately 2,595) following project-related dredging scheduled for the first 14 years of Alternative 4A implementation. AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting restoration activities and AMMs, there would be no permanent loss of this sensitive natural community and impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 2,299 acres of restoration would be needed to offset (i.e., mitigate) the 2,299 acres of loss, conversion, and disturbance. Impacts associated with changes in tidal perennial aquatic natural community as a result of implementing Alternative 4A would be less than significant. No mitigation is required.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Alternative 4A would not result in periodic effects on the tidal perennial aquatic natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include diverting Sacramento River flows in the north Delta, and reduced diversion from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities, levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with project mitigation requirements. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

  The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 4A operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and conservation sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with conservation activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River and at Clifton Court Forebay would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed in the *Wildlife Species* section.
- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the alternative, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*, and the restoration and expansion of this community at Clifton Court Forebay. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the tidal perennial aquatic natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* and enlargement of Clifton Court Forebay would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage or value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal perennial aquatic natural community.

Tidal Brackish Emergent Wetland

Construction associated with Alternative 4A water conveyance facilities and the alternative's Environmental Commitments would not affect the tidal brackish emergent wetland natural community. Operation, maintenance, and management activities associated with the alternative could result in minor changes in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation.

As explained below, with the restoration and enhancement of tidal marsh as part of Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

No tidal brackish emergent wetland would be lost or converted under Alternative 4A.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with water conveyance facilities and Environmental Commitment 4 of Alternative 4A are constructed and the water management practices associated with changed reservoir operations, diversions from the north Delta, and marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions include water releases and diversions, access road and levee repair, and replacement of levee armoring, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh would be similar or less relative to the No Action Alternative (ELT). There would be no increase in the long-term average electrical conductivity at modeled Suisun Marsh locations, and for some locations long-term average electrical conductivity would decrease (see Chapter 8, *Water Quality*); therefore, there would not be a change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4A, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area Due to BDCP Shift in Export Location and Volume*, in the BDCP for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

- Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The project proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the study area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the study area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road and levee repair.* Periodic repair of access roads and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment (Environmental Commitment 11), would be a periodic activity associated with the long-term maintenance of restoration sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for special-status species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the alternative, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the tidal brackish emergent wetland natural community within the study area. There would be no adverse effect on the tidal brackish emergent wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the Environmental Commitments of Alternative 4A would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of small acreages of this community (see Table 12-4A-2). Small areas of this community could also be lost to the development of channel margin habitat associated with Environmental Commitment 6.

As explained below, with the restoration and enhancement of tidal habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-2. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Water Conveyance Facilities	1	10
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**1**	**10**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities for Alternative 4A would permanently eliminate an estimated 1 acre and temporarily remove 10 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 14 years of Alternative 4A implementation, as water conveyance facilities are constructed. Smaller areas of this natural community could be affected by levee breaching, grading, and contouring associated with Environmental Commitment 4 and Environmental Commitment 6 restoration activities. Natural communities restoration would add at least 295 acres of tidal wetland during the course of project restoration activities, which would expand the area of that habitat and offset the losses.

The individual effects of water conveyance facilities, Environmental Commitment 4, and Environmental Commitment 6 are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the Environmental Commitment discussion.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 1 acre and temporarily remove 10 acres of tidal freshwater emergent wetland community. Most of the loss would occur along rivers and canals in the central Delta from barge unloading facility construction (Old River on the east side of Victoria Island and Connection Slough at the north end of Bacon Island), and from transmission line construction (San Joaquin River and Potato Slough at the south and north ends of Venice Island, Connection Slough at the north end of Bacon Island, and Railroad Slough at the north end of Woodward Island; see Terrestrial Biology Mapbook). These losses would take place during the water conveyance facilities construction period.
- There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of water conveyance facilities. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities,* of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: The restoration activities associated with Environmental Commitment 4 would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of Environmental Commitment 11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough and Cosumnes/Mokelumne ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. A detailed review of the methylmercury issues associated with implementation of Alternative 4A is contained in Appendix 11F, *Substantive BDCP Revisions*. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *Environmental Commitment 12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.
- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this

time, but the majority of the enhancement activity would occur on narrow strips of habitat, including levees and channel banks. The improvements could occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the construction phase of Alternative 4A, the project would affect the tidal freshwater emergent wetland natural community through water conveyance facilities construction losses (1 acre permanent and 10 acres temporary). These losses would occur in the central Delta from construction of barge unloading facilities and transmission lines on the fringes of Venice, Bacon and Woodward Islands, and in various locations within the Yolo Bypass and the tidal restoration ROAs. An undetermined acreage would also be affected through channel margin habitat creation (Environmental Commitment 6) along the major Delta waterways.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A Environmental Commitments. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 295 acres of tidal wetland as part of Environmental Commitment 4 during the construction phase of Alternative 4A would more than offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 11 acres of restoration would be needed to offset (i.e., mitigate) the 11 acres of loss (the total permanent and temporary effects listed in Table 12-4A-2).

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The creation of 295 acres of tidal wetland as part of Environmental Commitment 4 during the construction phase of Alternative 4A would more than offset the construction and restoration effects of implementing water conveyance facilities and Environmental Commitment 6, avoiding any adverse effect. Because of the 295 acres of tidal wetland restoration that would occur as part of Alternative 4A, the project would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 11 acres of tidal freshwater emergent wetland natural community (permanent and temporary) due to construction of the water conveyance facilities. The construction losses would occur in primarily in the central Delta on the fringes of Venice, Bacon and Victoria Islands, and in the Yolo Bypass and various tidal restoration ROAs. An unknown amount of tidal freshwater emergent wetland could also be lost to channel margin habitat creation (Environmental Commitment 6).The losses would be spread across the Alternative 4A construction timeframe and would be offset by planned restoration of 295 acres of tidal wetland scheduled for the first 14 years of Alternative 4A implementation (Environmental Commitment 4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 11 acres of restoration would be needed to offset (i.e., mitigate) the 11 acres of loss. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. The impact would be less than significant. No mitigation is required.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Alternative 4A would not result in periodic effects on the tidal freshwater emergent wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions would include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4A (Operational Scenario H) would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the project. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a significant reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.

- The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4A, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area Due to BDCP Shift in Export Location and Volume*, in the BDCP for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

- Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*). The project proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.2.18, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the study area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the study area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (Environmental Commitment 11). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed in the *Wildlife Species* section.
- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for special-status species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with Alternative 4A, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance, and management activities would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A, including changed water operations in the upstream reservoirs, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of water conveyance facilities, Environmental Commitment 4, and Environmental Commitment 6 would result in both permanent and temporary removal of this community (see Table 12-4A-3). Implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles over the term of the project to benefit the valley/foothill riparian natural community.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of mature riparian forest in either CZ4 or CZ7 (Resource Restoration and Performance Principle VFR2).
- The mature riparian forest intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum patch size of 50 acres and minimum width of 330 feet where practicable (Resource Restoration and Performance Principle VFR3).

As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-3. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Water Conveyance Facilities	37	24
Environmental Commitment 4[a]	11	0
Environmental Commitment 6	UNK	UNK
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**48**	**24**

[a] See discussion below for a description of applicable Environmental Commitments.
UNK = Unknown quantity but impact possible

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing Alternative 4A

Construction, land grading and habitat restoration activities that would accompany the implementation of water conveyance facilities and Environmental Commitment 4, would permanently eliminate an estimated 48 acres and temporarily remove 24 acres of valley/foothill riparian natural community in the study area. Also, a relatively small but unknown amount of habitat could be affected by *Environmental Commitment 6 Channel Margin Enhancement.* These modifications represent approximately 0.5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the construction of Alternative 4A and as habitat restoration is initiated. Valley/foothill riparian protection (103 acres) and restoration (251 acres) would be initiated during the same period, which would offset the losses.

The individual effects of each relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 37 acres and temporarily remove 24 acres of valley/foothill riparian natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees (acacia) and scrub vegetation (see Terrestrial Biology Mapbook). Cottonwood, willow and mixed brambles would be permanently lost at manmade ponds located north and south of Twin Cities Road just west of Interstate 5, as these sites would be used to deposit reusable tunnel material. Some cottonwood and valley oak riparian would be lost due to construction of a permanent access road from the new forebay west to an RTM disposal area. Blackberry brambles would also be lost to deposit of reusable tunnel material at the east end of Bouldin Island. Smaller areas dominated by blackberry would be eliminated at the forebay site adjacent to Clifton Court Forebay and patches of willow and blackberry would be lost along the transmission line corridors where they cross waterways in the central and south Delta. Permanent losses would occur along Lambert Road where temporary transmission lines would be installed. Temporary losses would also occur adjacent to temporary intake work areas. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak, cottonwood, willow and scrub vegetation. These losses would take place during the Alternative 4A construction period.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated11 acres of valley/foothill riparian community. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1). No losses would occur in the Suisun Marsh ROA. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (see BDCP Chapter 5, Section 5.4.5.1.1, *Permanent Loss and Fragmentation*). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.
- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 7 Riparian Natural Community Restoration:* The valley/foothill riparian natural community would be restored primarily in association with the tidal (Environmental Commitment 4) and channel margin (Environmental Commitment 6) enhancements. A total of 251 acres of this community would be restored and 103 acres would be protected during the construction period (14 years) of the project. A variety of successional stages would be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4Aenviornmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 4A would affect the valley/foothill riparian natural community through water conveyance facilities construction losses (37 acres permanent and 24 acres temporary) and the Environmental Commitment 4 restoration actions (11 acres permanent). The water conveyance facilities losses would occur along the eastern bank of the Sacramento River at intake sites; along transmission lines in the central and south Delta and along Lambert Road; and at RTM storage sites near Twin Cities Road, Clifton Court Forebay, and on Bouldin Island. The 11 acres of Environmental Commitment 4 losses would occur in one or more of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with Alternative 4A environmental commitments described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined in Section 404 of the CWA. As indicated above, most of the losses would be in small patches or narrow strips along waterways, with limited structural complexity. However, the restoration of up to 251 acres and protection (including significant enhancement) of 103 acres of valley/foothill riparian natural community as part of Environmental Commitment 7 and Environmental Commitment 3 during the Alternative 4A construction period would minimize this loss, avoiding any adverse effect. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 72 acres of protection and 72 acres of restoration would be needed to offset (i.e., mitigate) the 72 acres of loss (the combination of permanent and temporary losses listed in Table 12-4A-3). The combination of the two approaches (protection and restoration) are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Implementation of Alternative 4A would result in the loss of approximately 0.5% of valley/foothill riparian natural community in the study area. These losses (48 acres of permanent and 24 acres of temporary) would be largely associated with construction of the water conveyance facilities and inundation during tidal marsh restoration (Environmental Commitment 4). Inundation losses would occur through the course of the project's tidal marsh restoration program at various tidal restoration sites throughout the study area. By the end of the project's construction period, a total of 251 acres of this natural community would be restored and 103 acres would be protected (Environmental Commitment 7 and Environmental Commitment 3, respectively), primarily in CZ 4 and CZ 7 in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1).

NEPA Effects: The restoration of up to 251 acres and protection (including significant enhancement) of 103 acres of valley/foothill riparian natural community as part of Environmental Commitment 7 and Environmental Commitment 3 together with Resource restoration and performance principles VFR1-VFR3 during the construction period for Alternative 4A would minimize the loss of this community, avoiding any adverse effect. Because of the project's commitment to restoration of up to 251 acres and protection of up to 103 acres of valley/foothill riparian natural community during the course of the project, Alternative 4A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 72 acres of valley/foothill riparian natural community due to construction of the water conveyance facilities and inundation during tidal marsh restoration (Environmental Commitment 4). The construction losses would occur primarily along the Sacramento River at intake sites; along transmission corridors in the central and south Delta and along Lambert Road; and at reusable tunnel material storage sites on Bouldin Island, Clifton Court Forebay and near Twin Cities Road, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across the 14-year construction time frame of the project. These losses would be minimized by planned restoration of up to 251 acres (Environmental Commitment 7) and protection (including significant enhancement) of 103 acres (Environmental Commitment 3) of valley/foothill riparian natural community scheduled for the construction period of Alternative 4A, which would be guided by Resource Restoration and Performance Principles VFR1-VFR3. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts.

Because of these restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 72 acres of protection and 72 acres of restoration would be needed to offset (i.e., mitigate) the 72 acres of loss. The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Therefore, the impact would be less than significant.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Alternative 4A would not result in periodic effects on the valley/foothill riparian natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with Alternative 4A, as compared to no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with Operational Scenario H) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would

be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for Alternative 4A (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*), flow levels in these upstream rivers could be reduced by as much as 33% (Feather River at confluence with Sacramento River) in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 31% (Feather River at confluence with Sacramento River) with implementation of Alternative 4A. Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 4–32% compared with No Action, depending on month and water-year type (see Appendix 11C, Section 11C.11, *Alternative 4A*). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4A would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Chapter 8, *Water Quality*. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the project. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.
- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM18. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with implementation of Alternative 4A would not result in a net permanent reduction in the valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation.

The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, and AMM18 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Restoration and protection activities associated with *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management and Environmental Commitment 4 associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-4). Tidal restoration (Environmental Commitment 4) and channel margin habitat enhancement (Environmental Commitment 6) could also remove small areas of this natural community.

As explained below, with the restoration and enhancement of nontidal wetland habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-4. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	58	6
Environmental Commitment 4[a]	2	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**60**	**6**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities and tidal restoration (Environmental Commitment 4) would permanently eliminate an estimated 60 acres and temporarily remove 6 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 1.2% of the 5,567 acres of the community that is mapped in the study area. Natural communities restoration would add 832 acres (Environmental Commitment 10) and protect up to 119 acres (Environmental

Commitment 3) of nontidal marsh during the same period which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998).

The individual effects of each relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 58 acres and temporarily remove 6 acres of nontidal perennial aquatic community. Most of the permanent loss would occur at the linear manmade ponds located north and south of Twin Cities Road just west of I-5 and an RTM storage site on Bouldin Island (see Terrestrial Biology Mapbook). Most of the temporary loss would occur where transmission line construction would cross Mandeville Island. These wetlands are linear ponds or small, isolated areas surrounded by agricultural land. These losses would take place during the Alternative 4A construction period.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Environmental Commitment 4 would convert an estimated 2 acres of nontidal perennial aquatic habitat. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would be undertaken within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Environmental Commitment 10 would entail restoration of up to 832 acres of nontidal marsh in CZs 2, 4, and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the Alternative 4A construction period, activities would affect the nontidal perennial aquatic community through water conveyance facilities construction and tidal restoration (60 acres permanent and6 acres temporary). Additional small losses could also occur during this time frame as channel margin habitat enhancement is implemented.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, creating 832 acres of nontidal marsh as part of Environmental Commitment 10 during the Alternative 4A construction period would offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 66 acres of restoration and 66 acres of protection would be needed to offset (i.e., mitigate) the 66 acres of loss. The project also includes protection of up to 119 acres of nontidal marsh habitat (Environmental Commitment 3). The protection acreage exceeds the typical 1:1 protection requirement and fully compensates for the construction losses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Implementation of Alternative 4A would result in relatively minor (1.2%) losses of nontidal perennial aquatic community in the study area. These losses (60 acres of permanent and 6 acres of temporary loss) would be largely associated with construction of the water conveyance facilities. By the end of project construction, a total of 832 acres of nontidal marsh would be restored. The restoration would potentially occur over a wide region of the study area, including within the Cosumnes/Mokelumne, Yolo Bypass, South Delta and East Delta ROAs (see Figure 12-1).

NEPA Effects: During the Alternative 4A construction period, creating 832 acres of nontidal marsh as part of Environmental Commitment 10 would offset the construction-related losses of 66 acres of nontidal perennial aquatic natural community. The effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 66 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities and tidal restoration. The construction losses would occur primarily at reusable tunnel material storage sites near Twin Cities Road and on Bouldin Island, and along the transmission corridor where it crosses Mandeville Island. In addition, an estimated 2 acres would be lost due to tidal natural communities restoration in one or more of the ROAs (see Figure 12-1). The losses would be spread across the Alternative 4A construction period (14 years). These losses would be offset by planned restoration of up to 832 acres and protection of up to 119 acres of nontidal marsh during the same time period (Environmental Commitment 10 and Environmental Commitment 3). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 66 acres of restoration and 66 acres of protection would be needed to offset (i.e., mitigate) the 66 acres of loss. The project includes tidal marsh restoration (832 acres) and protection (119 acres) which is well in excess of the typical 1:1 restoration and protection acreages, and therefore compensates for all project-related losses. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Therefore, the impact would be less than significant. No mitigation is required.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Alternative 4A would not result in periodic effects on the nontidal perennial aquatic natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 4A operations scheme would alter the surface elevations of these reservoir pools as described in Chapter 6, *Surface Water*. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management)*. Vegetation management is also the principal activity associated with *Environmental Commitment 13 Invasive Aquatic Vegetation Control.* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities*

Protection and Restoration. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal perennial aquatic natural community.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-5). Small losses of this community could also occur with tidal restoration (Environmental Commitment 4) and planned channel margin enhancement activities (Environmental Commitment 6).

As explained below, with the restoration and enhancement of nontidal marsh habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-5. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	2	4
Environmental Commitment 4[a]	1	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**3**	**4**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities and tidal restoration would permanently eliminate an estimated 3 acres and temporarily remove 4 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 0.5% of the 1,509 acres of the community that is mapped in the study area. Nontidal marsh restoration (Environmental Commitment 10) would add 832 acres of nontidal marsh and natural communities protection (Environmental Commitment 3) would protect up to 119 acres of nontidal marsh. These actions would be taken over the course of Alternative 4A marsh restoration activities, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. The nontidal marsh protection would be designed to support tricolored blackbird and western pond turtle populations in the study area. The restoration would occur in blocks that are contiguous with or near giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998), and in areas suitable for greater sandhill crane permanent roosting and foraging.

The individual effects of each relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 2 acres and temporarily remove 4 acres of tidal freshwater perennial emergent wetland community. The permanent losses would occur at the Clifton Court Forebay construction site and the RTM site on Bouldin Island (see Terrestrial Biology Mapbook). The temporary loss would occur in a temporary work area and where temporary powerlines would be constructed across Mandeville Island. These wetlands are extremely small and remote water bodies, surrounded by agricultural operations. These losses would take place during the project's construction period.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated 1 acre of tidal freshwater perennial emergent wetland. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Environmental Commitment 10 would entail restoration of up to 832 acres of nontidal marsh in CZs 2, 4, and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. Some of this marsh restoration would occur in 25-

acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project's construction time frame, Alternative 4A would affect the nontidal freshwater perennial emergent wetland community through water conveyance facilities construction and tidal restoration (Environmental Commitment 6) (3 acres permanent and 4 acres temporary). Small additional losses could result where channel margin habitat enhancement occurs along major Delta waterways (Environmental Commitment 6).

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with the project. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 832 acres and protecting 119 acres of nontidal perennial marsh as part of Environmental Commitment 3 and Environmental Commitment 10 during the construction of Alternative 4A would offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 7 acres of restoration and7 acres of protection would be needed to offset (i.e., mitigate) the 7 acres of loss. The project includes well in excess of the typical 1:1 restoration and protection acreages for this natural community.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Implementation of Alternative 4A would result in small (0.5%) losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (3 acres of permanent and 4 acres of temporary loss) would be associated with construction of the water conveyance facilities. By the end of water conveyance facilities construction, a total of 832 acres of nontidal marsh would be restored and 119 acres would be protected. The restoration would occur near giant garter snake occupied habitat and greater sandhill crane roosting and foraging areas in the eastern Delta. Approximately half of the 119 acres of protection would occur in CZ 1, 2, 8, or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1).

NEPA Effects: The combination of creating 832 acres and protecting 119 acres of nontidal perennial marsh as part of Environmental Commitment 3 and Environmental Commitment 10 would offset the losses associated with construction of water conveyance facilities and tidal restoration, avoiding any adverse effect. With 832 acres of nontidal marsh restoration and 119 acres of protection, Alternative 4A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 7 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities and tidal restoration. The construction losses would occur near Clifton Court Forebay and along transmission line construction areas on Mandeville Island, and tidal restoration would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1). The losses would occur during the project construction timeframe. These losses would be offset by planned restoration of up to 832 acres and protection of up to 119 acres of nontidal marsh (Environmental Commitment 10 and Environmental Commitment 3). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 7 acres of restoration and 7 acres of protection would be needed to offset (i.e., mitigate) the 7 acres of loss. The project includes well in excess of the typical 1:1 restoration and protection acreages and therefore compensates for the construction-related losses. The restoration and protection would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Because of these offsetting restoration and protection activities and AMMs, impacts would be less than significant.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Alternative 4A would not result in periodic effects on the nontidal freshwater perennial emergent wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect the nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the project's actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and facilities maintenance activities. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal freshwater perennial emergent wetland natural community.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of water conveyance facilities would result in a small permanent removal of this community (see Table 12-4A-6). Also, tidal restoration (Environmental Commitment 4) would remove a small estimated amount of alkali seasonal wetland complex. Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the alkali seasonal wetland natural community.

- Restore vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acreage (Resource Restoration and Performance Principle VP/AW2).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the protection, restoration, and enhancement of the amounts of habitat proposed for Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-6. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	1	0
Environmental Commitment 4[a]	1	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**2**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities under Alternative 4A would permanently eliminate an estimated 1 acre of alkali seasonal wetland complex natural community in the study area, a portion of which includes iodine bush scrub, a sensitive plant community. In addition, an estimated 1 acre of alkali seasonal wetland would be impacted through grading and/or inundation from tidal restoration activities. There would be no temporary impacts to alkali seasonal wetlands. These modifications represent approximately 0.05% of the 3,723 acres of the community that is mapped in the study area. The combined vernal pool/alkali seasonal wetland complex protection (188 acres) and restoration (48 acres) would be initiated during project construction; these actions would offset the losses.

The effects associated with construction of water conveyance facilities are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the individual Environmental Commitment discussion.

- *Water Facilities and Operation*: Construction of the Alternative 4A transmission lines immediately west of Clifton Court Forebay would permanently affect 1 acre of alkali seasonal wetland complex natural community (see the Terrestrial Biology Mapbook). The alkali seasonal wetland complex at this location is scattered and significantly degraded by past agricultural and water development-related activities. It is surrounded by or adjacent to vernal pool complex natural community.

The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, in the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *Environmental Commitment 3 Natural Communities Protection and Restoration:* Environmental Commitment 3 proposes to protect up to 188 acres of vernal pool/alkali seasonal wetland complex in the study area. The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated 1 acre of alkali seasonal wetland complex. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Environmental Commitment 9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the Environmental Commitment is to match the acreage of restoration with the actual acreage lost to other project measures (primarily water conveyance facilities). The current estimate for vernal pool/alkali seasonal wetland complex restoration is 48 acres. The goal is for no net loss of this natural community, consistent with the project's Resource Restoration and Performance Principles.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During project construction, Alternative 4A would affect the alkali seasonal wetland complex natural community through water conveyance facilities construction and tidal restoration (Environmental Commitment 4) (2 acres permanent).

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with the project's Environmental Commitments. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of up to 188 acres of combined vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3, the restoration of up to 48 acres of these communities as part of Environmental Commitment 9, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* would offset this loss, avoiding any adverse effect. AMM30 would require that transmission line construction avoid any losses of alkali seasonal wetland complex natural community to the maximum extent feasible (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, for a full description of AMM30). Because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 4 acres of protection and 2 acres of restoration would be needed to offset (i.e., mitigate) the 2 acres of loss.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Implementation of Alternative 4A would result in very minor (0.05%) losses of alkali seasonal wetland natural community in the study area. These losses (2 acres) would be associated with construction of the project's water conveyance facility and tidal restoration.

NEPA Effects: During the 14-year construction period for Alternative 4A, 188 acres of vernal pool/alkali seasonal wetland complex would be protected as part of Environmental Commitment 3 and 48 acres of these communities would be restored as part of Environmental Commitment 9, which would be guided by Resource Restoration and Performance Principles VP/AW2-VP/AW4. These Environmental Commitments would offset the loss of this community associated with water conveyance facilities and tidal restoration, avoiding any adverse effect. The protection and restoration would occur primarily in the Clifton Court Forebay area. Therefore, Alternative 4A would not have an adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion: Alternative 4A would result in the permanent loss of approximately 2 acres of alkali seasonal wetland complex natural community due to water conveyance facility construction and tidal restoration. The construction losses would occur primarily in the area adjacent to Clifton Court Forebay. The losses would occur during project construction. Tidal restoration losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).

The construction losses of this special-status natural community would represent a significant impact if they were not offset by avoidance and minimization measures and other actions associated with the project's environmental commitments. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of up to 188 acres of combined vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3, the restoration of up to 48 acres of these communities as part of Environmental Commitment 9, Resource Restoration and Performance Principles VP/AW2-VP/AW4, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* during construction of Alternative 4A would offset this loss, avoiding any significant impact. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 4 acres of protection and 2 acres or restoration would be needed to offset (i.e., mitigate) the 2 acres of loss. AMM1, AMM2, AMM3, AMM4, and AMM10 would also be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Natural Community

Alternative 4A would not result in periodic effects on the alkali seasonal wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A were constructed and the stream flow regime associated with changed water management was in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces

as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the alkali seasonal wetland complex natural community.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the Environmental Commitments of Alternative 4A would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Initial development and construction of water conveyance facilities would result in permanent removal of 19 acres of this community and tidal restoration would result in the conversion of an estimated 25 acres of vernal pool complex (see Table 12-4A-7). Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the vernal pool complex natural community.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Restore vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acreage (Resource Restoration and Performance Principle VP/AW2).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the protection, restoration and enhancement of the amounts of habitat proposed for Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-7. Changes in Vernal Pool Complex Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	19	3
Environmental Commitment 4[a]	25	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**44**	**3**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities and tidal restoration would permanently eliminate an estimated 44 acres and temporarily remove 3 acres of vernal pool complex natural community in the study area. These acreages are based on the proposed location of the water conveyance facilities construction footprint and the estimated effects from tidal restoration (Environmental Commitment 4). The loss of this combined 47 acres would represent approximately 0.4% of the 12,133 acres of the community that is mapped in the study area. Vernal pool/alkali seasonal wetland complex protection (188 acres) and restoration (48 acres) would be initiated during the Alternative 4A construction period to counteract the loss of habitat. Because of the high sensitivity of this natural community and its shrinking presence in the study area, avoidance and minimization measures have been built into the project to eliminate the majority of this potential loss.

The individual effects of water conveyance facilities are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would directly affect 22 acres of vernal pool complex natural community, including 19 acres permanently affected and 3 acres temporarily affected. A portion of this habitat adjacent to Clifton Court Forebay includes iodine bush scrub, a sensitive plant community. The permanent loss would occur along the southern edge of Clifton Court Forebay, where the forebay would be expanded to provide greater storage capacity and from the construction of permanent transmission lines. The temporary losses would occur in a temporary work area immediately adjacent to Clifton Court Forebay (see Figure 12-1 and the Terrestrial Biology Mapbook).
- Because of the close proximity of construction activity to adjacent vernal pool complex near Clifton Court Forebay, there is also the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis in the *Wildlife Species* section.
- The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay and Stone Lakes NWR. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located

west of the major construction areas at Clifton Court Forebay and east of the construction areas adjacent to Stone Lakes NWR. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. At Stone Lakes NWR, USFWS refuge management undertakes active invasive species control, including use of grazing. No adverse effect is expected.

- *Environmental Commitment 3 Natural Communities Protection and Restoration:* Environmental Commitment 3 proposes to protect up to 188 acres of vernal pool complex/alkali seasonal wetland complex, primarily in the Clifton Court Forebay area. The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated 25 acres of vernal pool complex. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Environmental Commitment 9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool/alkali seasonal wetland complex restoration is 48 acres. This restoration Environmental Commitment includes a “no net loss” policy normally applied to this natural community.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project construction period (14 years), Alternative 4A could directly affect 47acres of vernal pool complex natural community through construction-related losses in habitat from water conveyance facilities and tidal restoration.

The construction loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with the project’s Environmental Commitments. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of up to 188 acres of vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3 and the restoration of up to 48 acres of these communities (including a commitment to have restoration keep pace with losses) as part of Environmental Commitment 9 during construction of Alternative 4A facilities would offset this loss. The project focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8, and CZ 11 (see Figure 12-1). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 94 acres of protection and 47 acres of restoration would be needed to offset (i.e., mitigate) the 47 acres of loss. In addition, because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat.

To further avoid adverse effect, the project includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM30 Transmission Line Design and Alignment Guidelines.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. With these AMMs in place, Alternative 4A would not adversely affect vernal pool complex natural community.

NEPA Effects: The Environmental Commitments associated with Alternative 4A include protection of up to 188 acres (Environmental Commitment 3) and restoration of an estimated 48 acres (Environmental Commitment 9) of vernal pool/alkali seasonal wetland complex, which would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4. The project focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). A core area exists in CZ 1 (see Figure 12-1). With these Environmental Commitments and AMMs in effect through the entire project period, Alternative 4A would not have an adverse effect on the vernal pool complex natural community.

CEQA Conclusion: During the 14-year construction period, Alternative 4A could result in the direct loss of approximately 47 acres of vernal pool complex natural community due to construction of the water conveyance facility and tidal restoration.

The construction-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with Alternative 4A Environmental Commitments. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of up to 188 acres of vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3 and the restoration of an estimated 48 acres of this community (including a commitment to have restoration keep pace with losses) as part of Environmental Commitment 9 during the construction of Alternative 4A facilities would offset this loss, Resource Restoration and Performance Principles VP/AW1-VP/AW4. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 94 acres of protection and 47 acres of restoration would be needed to offset (i.e., mitigate) the 47 acres of loss. Alternative 4A also includes AMM1, AMM2, AMM3, AMM4, AMM10, AMM12, and AMM30 to minimize impacts. Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

Alternative 4A would not result in periodic effects on the vernal pool complex natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the major Sacramento River system and Delta waterways.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as part of *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, and AMM30. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12,and AMM30 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the vernal pool complex natural community.

Managed Wetland

The construction of water conveyance facilities for Alternative 4A would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-8). Also, tidal restoration (Environmental Commitment 4) would result in the removal or conversion of managed wetland (see Table 12-4A-8).

Creation of similar habitat values by restoring nontidal marsh as part of Environmental Commitment 10 would offset the losses of managed wetland. The net effect would be a decrease in the amount of managed wetland, but an increase in similar habitat value for special-status and common species as cultivated land is converted to nontidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to Impacts BIO-178 through BIO-183 in the *Shorebirds and Waterfowl* discussion for further consideration of the effects of removing managed wetland natural community.

Table 12-4A-8. Changes in Managed Wetland Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	16	25
Environmental Commitment 4[a]	20	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**36**	**25**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities and tidal restoration (Environmental Commitment 4) would permanently eliminate an estimated 36 acres and temporarily affect 25 acres of managed wetland in the study area. These modifications represent approximately 0.09% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur over the course of Alternative 4A construction (14 year period). Alternative 4A does not include protection or restoration actions directed specifically at managed wetland, but protection and restoration of nontidal wetland (119 acres and 832 acres, respectively) would replace the habitat values lost for special-status wildlife and plant species.

The individual effects of the relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 16 acres and temporarily remove 25 acres of managed wetland community. The permanent losses would occur near the northeast corner of Clifton Court

Forebay for the construction of a permanent shaft location, a permanent transmission line west of Clifton Court Forebay, and a permanent access road on Bouldin Island. Temporary impacts would occur in association with temporary work areas on Mandeville Island, a concrete batch plant on Bouldin Island, and a tunnel muck conveyor facility near Clifton Court Forebay (see the Terrestrial Biology Mapbook). Smaller losses would occur from construction of the temporary transmission lines that parallel the tunnel alignment northwest of the intermediate forebay and across the length of Mandeville Island.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated 20 acres of managed wetlands. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During construction of the water conveyance facility and implementation of tidal restoration, Alternative 4A would permanently remove 36 acres and temporarily remove 25 acres of managed wetland.

The construction loss of this special-status natural community would represent an adverse effect if it were not offset by the Environmental Commitments described in Chapter 3, Section 3.5.18.2, *Environmental Commitments*. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of up to 832 acres of nontidal wetland (Environmental Commitment 10) and protection and enhancement of 119 acres (Environmental Commitment 3) of nontidal wetland during the Alternative 4A construction period would offset the loss of the habitat values associated with managed wetland associated with water conveyance facilities managed wetland loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 61 acres of protection would be needed to offset the 61 acres of loss associated with water conveyance facilities. The protection and restoration of nontidal marsh associated with Alternative 4A would fully compensate for the loss in habitat value associated with the managed wetland loss.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 4A, there would be a net reduction in the acreage of this special-status natural community. This would be an adverse effect when judged by the significance criteria used for analysis of terrestrial biological resources (see Section 12.3.1.2, *Significance Criteria for Terrestrial Biological Resources*). However, the creation of nontidal marsh habitats (832 acres) that support similar ecological functions would offset this adverse effect. Also, there are other Environmental Commitments contained in the project (Environmental Commitment 3 and Environmental Commitment 11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

NEPA Effects: Alternative 4A would result in a loss of 61 acres of managed wetland within the study area; however, it would also protect and enhance up to 119 acres and restore up to 832 acres of habitat (nontidal wetland) with similar wildlife values. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion: During the project's construction time frame (14 years), Alternative 4A would permanently remove 36 acres and temporarily remove 25 acres of managed wetland through construction-related losses in habitat from water conveyance facilities activities and tidal restoration.

The construction loss of this special-status natural community would represent a significant impact if it were not offset by other the Environmental Commitments described in Chapter 3, Section 3.5.18.2. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of up to 832 acres and protection and enhancement of 119 acres of nontidal marsh as part of Environmental Commitment 3 and Environmental Commitment 10 during construction of Alternative 4A would fully offset the losses in habitat value associated with water conveyance facilities. Typical project-level mitigation ratios (1:1 for protection) would indicate 61 acres of protection would be needed to offset the 61 acres of loss associated with water conveyance facilities. The combined protection and restoration proposed for nontidal marsh would offset the loss of wildlife habitat value. This acreage would significantly exceed the number of acres of managed wetland lost.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In spite of the nontidal marsh protection and restoration contained in Alternative 4A, there would be a net reduction in the acreage of managed wetland special-status natural community. This would be a significant impact when judged by the significance criteria listed in Section 12.3.1.2, *Significance Criteria for Terrestrial Biological Resources*. However, there are other Environmental Commitments contained in the project (Environmental Commitment 3, Environmental Commitment 10 and Environmental Commitment 11) that would improve management and enhance existing habitat values and expand habitat with similar values, further offsetting the impacts of managed wetland loss on special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Alternative 4A would not result in periodic effects on the managed wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include changes in operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance and vegetation management. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection and restoration actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in acreage of managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion**:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection and restoration actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the managed wetland natural community.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7. The only project conservation activity that would potentially affect this natural community is the channel margin enhancement measure (Environmental Commitment 6) (see Table 12-4A-9).

Table 12-4A-9. Changes in Other Natural Seasonal Wetland Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	0	0
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	UNK	UNK
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	**0**	**0**

UNK = unknown

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing Alternative 4A

Because specific locations for implementing Alternative 4A's *Environmental Commitment 6 Channel Margin Enhancement* have not been identified, it is not known whether the creation of channel margin habitats along study area streams would remove other natural seasonal wetland community habitats. Several small patches of other natural seasonal wetland natural community are mapped along study area waterways. Because the areas of this community are small, and because their habitat values are also provided by other seasonal wetlands in the study area, the small potential that other natural seasonal wetland would be removed by channel margin enhancement is not expected to create an adverse effect on the special-status species that use this habitat.

NEPA Effects: Alternative 4A Environmental Commitments would not adversely affect other natural seasonal wetland natural community because of the small potential for this community to be displaced.

CEQA Conclusion: This community would not be significantly impacted because of the small potential for channel margin enhancement to displace other natural seasonal wetland acreage. There would be no substantial impact on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the project actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of

sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.
- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared to the restoration activities planned as part of *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool/alkali seasonal wetland complex Environmental Commitment (Environmental Commitment 9) includes restoration of up to 48 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the other natural seasonal wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the other natural seasonal wetland natural community.

Grassland

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of water conveyance facilities, tidal restoration (Environmental Commitment 4), and riparian restoration (Environmental Commitment 7) would result in both permanent and temporary removal of this community (see Table 12-4A-10). Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the grassland natural community.

- Restore grasslands to connect fragmented patches of protected grassland and to provide upland habitat (Resource Restoration and Performance Principle G1).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical sites (Resource Restoration and Performance Principle G3).
- Increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (Resource Restoration and Performance Principle G4).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).
- Protect grassland on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Resource Restoration and Performance Principle G8).

- Create or protect high-value upland giant garter snake habitat adjacent to the nontidal perennial aquatic habitat being restored and created (Resource Restoration and Performance Principle G9).
- Protect up to 647 acres of grassland in the Byron Hills area where practicable and/or in other appropriate locations (Resource Restoration and Performance Principle G10).

As explained below, with the protection, restoration and enhancement of the amounts of habitat included in the project, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-10. Changes in Grassland Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	467	158
Environmental Commitment 4[a]	40	0
Environmental Commitment 7[a]	1	0
Environmental Commitment 10[a]	0	0
Environmental Commitment 11[a]	20	0
TOTAL IMPACTS	**528**	**158**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities, tidal restoration (Environmental Commitment 4), and riparian restoration (Environmental Commitment 7) would permanently eliminate an estimated 528 acres and temporarily remove 158 acres of grassland natural community in the study area. These modifications represent approximately 0.9% of the 78,047 acres of the community that is mapped in the study area.

The individual effects of each relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 467 acres and temporarily remove 158 acres of grassland natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland;; a reusable tunnel material storage site on Bouldin Island; at a permanent pipeline shaft access road on the east side of Bacon Island; and at various permanent facility sites around Clifton Court Forebay, including a reusable tunnel material storage site, new canal connections from Clifton Court Forebay to the two aqueducts, and in the forebay expansion area on the south side of the existing forebay. Most of the permanent losses would be of ruderal and herbaceous grassland areas that exist in very narrow bands adjacent to waterways, levees and roads (see the Terrestrial Biology Mapbook). Some of the grassland lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland. A portion of the grassland habitat adjacent to Clifton Court Forebay includes iodine bush scrub, a sensitive plant community. The temporary losses would be associated with construction of the temporary access roads along the Sacramento River; temporary transmission lines; at work areas and barge offloading facility construction sites at the south end of Bouldin Island, at the north end of Bacon Island, and the south end of Venice Island and at the northwest corner of Victoria Island; at temporary access road sites on the northern and southern ends of Bacon Island and the northwest corner of Victoria Island; at temporary work areas on Mandeville and Bacon Islands; at the operable barrier construction site at the head of Old River, and various locations around Clifton Court Forebay. These losses would take place during the Alternative 4A construction period.

- The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction in and around the forebay would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.
- *Environmental Commitment 3 Natural Community Protection and Restoration*: Approximately 1,060 acres of grassland natural community would be protected to restore and enhance aquatic and upland habitat for a number of amphibian, reptile and mammal special-status species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove an estimated 40 acres of grassland. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 7 Riparian Natural Community Restoration:* Environmental Commitment 7 would permanently remove an estimated 1 acre of grassland.
- *Environmental Commitment 8 Grassland Natural Community Restoration:* Up to 1,070 acres of grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZ 1, CZ 8, and CZ 11, as proposed by the BDCP.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the project. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas.

The following paragraphs summarize the combined effects discussed above and describe other project Environmental Commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project's construction timeframe, Alternative 4A would affect the grassland natural community through water conveyance facilities construction, tidal restoration (Environmental Commitment 4), and riparian restoration (Environmental Commitment 7) (528 acres permanent and 158 acres temporary).

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this section because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see Chapter 3, *Conservation Strategy*, of the BDCP). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses in the *Wildlife Species* section. In addition, the loss of iodine bush scrub located in grassland adjacent to Clifton Court Forebay would be an adverse effect. The combination of restoring 1,070 acres grassland (Environmental Commitment 8), protecting and enhancing 1,060 acres (Environmental Commitment 3) of grassland natural community during the construction phase of the project (14 years), and the commitment to restore temporarily affected grassland (158 acres) to its pre-project condition within one year of completing construction as required by *AMM10 Restoration of Temporarily Affected Natural Communities*, would offset this construction loss, avoiding any loss in the value of this habitat for special-status species. The protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (Environmental Commitment 3 and Environmental Commitment 11). Typical project-level mitigation ratios (2:1 for protection) would indicate that 1,372 acres of protection would be needed to offset (i.e., mitigate) the 686 acres of combined permanent and temporary loss. In addition, because it is not possible to create iodine bush scrub, mitigation for impacts on this plant community must be through avoidance and/or protection of compensating mitigation areas. Protection of iodine bush scrub within the grassland/vernal pool complex/alkali seasonal wetland habitats adjacent to Clifton Court Forebay provides the only opportunity in the Plan Area to protect this habitat. The combination of protection, along with the enhancement and management associated with Environmental Commitment 3 and Environmental Commitment 11 contained in the project, is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: By the end of the project's construction time frame, a total of 1,060 acres of grassland would be protected (Environmental Commitment 3) and 1,070 acres of grassland would be restored (Environmental Commitment 8), which would be guided by Resource Restoration and Performance Principles G1, G3, G4, and G7-G10. The protection would occur primarily in the west Delta and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity as described in AMM10. There would be a permanent and temporary loss of 686 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 4A would replace the habitat lost and improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion: Alternative 4A would result in the permanent and temporary loss of approximately 686 acres of grassland natural community due to construction of the water conveyance facilities.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this section because grassland is not considered a special-status or sensitive natural community. Nonetheless, these losses would be offset by planned restoration of 158 acres of temporarily affected grassland, the restoration of up to 1,070 acres of grassland, and protection of up to 1,060 acres of grassland natural community scheduled for the 14-year construction period of Alternative 4A, which would be guided by Resource Restoration and Performance Principles G1, G3, G4, and G7-G10. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (2:1 for protection) would indicate that 1,372 acres of protection would be needed to offset (i.e., mitigate) the 686 acres of loss. The combined protection (1,060 acres) and restoration (1,070 acres) of 2,130 acres of grassland would more than offset the losses from the project. The combination of two approaches (protection and restoration) contained in the project Environmental Commitments and avoidance and minimization measures is designed to avoid a temporal lag in the value of grassland habitat available to special-status species. The protection and restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species. Therefore, there would be a less-than-significant impact on the grassland natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Alternative 4A would not result in periodic effects on grassland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect grassland natural community in the study area.

The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with project actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Community Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and enhancement activities planned as part of *Environmental Commitment 3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the grassland natural community.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community consists of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1). While inland dune scrub is within the study area, none of the Alternative 4A actions is expected to affect this community.

Cultivated Lands

Cultivated lands is the major land cover type in the study area (487,106 acres, see Table 12-1 in Section 12.1.2, *Land Cover Types*). The Delta, the Yolo Bypass and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 in Section 12.1.3, *Special-Status Species*, list special-status wildlife species supported by cultivated lands.

The effects of Alternative 4A on cultivated lands are discussed from various perspectives in this document. Chapter 14, *Agricultural Resources*, includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species in this section also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses, there is no separate analysis of this land cover type presented here. For Alternative 4A, the total loss (permanent and temporary) is estimated to be 7,043 acres. The majority of the permanent loss would be associated with tidal marsh restoration (Environmental Commitment 4; 192 acres), riparian natural community restoration (Environmental Commitment 7; 250 acres), grassland restoration (Environmental Commitment 8; 1,070 acres), nontidal marsh restoration (Environmental Commitment 10; 832 acres), and construction of the modified tunnel and associated water conveyance facilities (permanent removal of 3,544 acres and temporary removal 1,155 acres of cultivated lands). Of the 7,043 acres, 6,844 would be made up of croplands and the other 199 acres would be non-cropland agricultural areas.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized as developed lands (90,660 acres). Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities (see Figure 12-1 and the Terrestrial Biology Mapbook). Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap provide giant garter snake habitat.

As with cultivated lands, no effort has been made to analyze the effects of Alternative 4A activities on this land cover type because it is not a natural community. The effects of its conversion are discussed in Chapter 13, *Land Use*. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the Environmental Commitments, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but which do not include topographic depressions that are characteristic of vernal pool crustacean habitat.

Alternative 4A would result in permanent losses (see Table 12-4A-11) and indirect conversions of vernal pool crustacean modeled habitat. Alternative 4A would also include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit vernal pool crustaceans.

- Restore vernal pool complex and alkali seasonal wetland suitable for vernal pool crustaceans to achieve no net loss of wetted acreage (Environmental Commitment 9, Resource Restoration and Performance Principle VP/AW2).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Protect up to 188 acres of existing vernal pool/alkali seasonal wetland complex (Environmental Commitment 3) in the greater Byron Hills area, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-11. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary	Indirect
Water Conveyance Facilities	High-value	13	1	42
	Low-value	7	2	0
Total Impacts Water Conveyance Facilities		**20**	**3**	**42**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	17	0	3
	Low-value	8	0	1
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**25**	**0**	**4**
TOTAL IMPACTS		**45**	**3**	**46**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 4A would result in the direct permanent and temporary loss combined of 48 acres of modeled vernal pool crustacean habitat from conveyance facilities construction and tidal restoration. In addition, water conveyance facilities construction and tidal restoration that causes hydrologic changes could result in the indirect conversion of an additional 45 acres of high-value and 1 acre of low-value vernal pool crustacean habitat. Construction of the water conveyance facilities and tidal restoration projects may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place. Habitat enhancement and management activities (Environmental Commitment 11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 4A would also result in impacts on critical habitat for vernal pool fairy shrimp (185 acres). These impacts would be from water conveyance facilities construction west of Clifton Court Forebay. Of the 185 acres of vernal pool fairy shrimp critical habitat, only 5 acres consist of modeled habitat for vernal pool crustaceans, with the remainder consisting of cultivated lands.

As specified in *AMM12 Vernal Pool Crustaceans* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, restoration projects are designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent habitat restoration activities, in particular tidal restoration. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines avoid removal of wetted acres of vernal pools and alkali seasonal wetlands wetted acres of aquatic habitats to the maximum extent feasible. The term wetted acres refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involve an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 23 acres of vernal pool crustacean habitat, composed of 14 acres of high-value and 9 acres of low-value habitat (Table 12-4A-11). The construction of the conveyance facilities would result in the permanent loss of habitat associated with a vernal pool fairy shrimp CNDDB occurrence as a result of the expansion of Clifton Court Forebay. In addition, conveyance facility construction could result in the indirect conversion of 42 acres of high-value vernal pool crustacean habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, from the storage of RTM, and permanent access roads. There are records of vernal pool fairy shrimp and midvalley fairy shrimp in the vicinity of these areas (California Department of Fish and Game 2013). Alternative 4A would also result in the permanent loss of 185 acres of critical habitat for vernal pool fairy shrimp. The permanent impacts on critical habitat are associated with the RTM disposal areas and an associated access road west of Clifton Court Forebay (177 acres), a new transmission line (5 acres), and upgrades to a permanent access road just south of this area (3 acres). However, as discussed above, only 5 acres of this critical habitat consists of modeled habitat for vernal pool crustaceans and the remaining critical habitat consist of cultivated lands that are not suitable for the species. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines are designed to avoid removal of aquatic habitats to the maximum extent feasible.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of an estimated 25 acres of modeled vernal pool crustacean habitat (17 acres high value and 8 acres low value habitat). Tidal restoration would also result in the indirect conversion of an estimated 4 acres of modeled vernal pool crustacean habitat. The effects would take place in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* The project's restoration/creation of vernal pools to achieve no net loss and the protection of up to 188 acres of vernal pool/alkali seasonal wetland complex would benefit vernal pool crustaceans. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The proposed conservation efforts have been evaluated to determine whether they would provide sufficient habitat protection and restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4A-11 lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. Table 12-4A-12 was prepared to further analyze the project's effects on vernal pool crustaceans using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of habitat. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the project area it is likely that the actual densities within the project area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4A-12. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 4A (acres)

	Direct Loss	Indirect Conversion
AMM 12 Impact Limit	10	20
Water Conveyance Facilities[a]	3.45	6.30
Environmental Commitments 4, 6-7, 9-11	3.75	0.60
Total	**7.2**	**6.9**

[a] These acreages were generated by assuming that the modeled habitat identified in Table 12-4A-11 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by Alternative 4A would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 7.2 wetted acres of vernal pool crustacean habitat (or 48 acres of vernal pool/alkali seasonal wetland complex) should be restored and 28.2 wetted acres (or 188 acres of vernal pool/alkali seasonal wetland complex) protected to mitigate Alternative 4A's direct and indirect effects on vernal pool crustacean habitat. With the implementation of AMM30, the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay.

Project proponents would commit to protecting up to 188 acres of vernal pool/alkali seasonal wetland complex by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. Alternative 4A has also committed to restoring/creating vernal pools and alkali seasonal wetlands such that there is no net loss of vernal pool acreage. The final amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools and/or alkali seasonal wetlands suitable for the species would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted

acres of vernal pools and/or alkali seasonal wetlands suitable for the species would be restored for each wetted acre directly affected (1.5:1 ratio).

The protection and restoration efforts would include the following the Resource Restoration and Performance Principles.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW2).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of vernal pool crustacean habitat under Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management and enhancement would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, and AMM30, which would be in place throughout the period of construction and operations. Considering these commitments, losses and conversion of vernal pool crustacean habitat under Alternative 4A would not be an adverse effect.

CEQA Conclusion: Alternative 4A would have significant impact on vernal pool crustacean habitat as a result of habitat modification of a special-status species and potential for direct mortality in the absence of the protection and restoration of habitat. However, the project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 9, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4 and effects would be avoided and minimized by AMM1–AMM6, AMM10, AMM12, and AMM30, which would be in place throughout the period of construction and operations. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 4A would have a less-than-significant impact on vernal pool crustaceans under CEQA.

Impact BIO-33: Indirect Effects of Alternative 4A on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. These potential effects would be avoided and minimized through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the period of construction and operations. The indirect effects of Alternative 4A on vernal pool crustaceans and their habitat would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of these work areas. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the period of construction and operations. The indirect impacts of Alternative 4A on vernal pool crustaceans would be less than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on vernal pool crustacean habitat.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Valley Elderberry Longhorn Beetle

The habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (vernal pool complexes and grasslands within 200 feet of channels). Alternative 4A would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-4A-13. The majority of the losses would take place over an extended period of time as the restoration Environmental Commitments are being implemented. In addition, an estimated 14 elderberry shrubs that were previously mapped by DWR in the DHCCP Conveyance Planning Area could be impacted by the Alternative 4A water conveyance alignment. Full implementation of Alternative 4A would also include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit valley elderberry longhorn beetle.

- Mitigate impacts on elderberry shrubs consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a) for the species and planting shrubs in high-density cluster (Resource Restoration and Performance Principle VELB1).

- Site elderberry longhorn beetle habitat restoration with drainage immediately adjacent to or in the vicinity of occupied habitat (Resource Restoration and Performance Principle VELB2).
- Restore up to 251 acres of valley/foothill riparian (Environmental Commitment 7).
- Protect up to 103 acres of valley/foothill riparian (Environmental Commitment 3).

As explained below, with the restoration and protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-13. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Riparian	37	24
	Nonriparian	201	87
Total Impacts Water Conveyance Facilities		**238**	**111**
Environmental Commitments 4, 6–7, 9–11[a]	Riparian	11	0
	Nonriparian	12	0
Total Impacts Environmental Commitments 4, 6–7, 9–11a		**23**	**0**
TOTAL IMPACTS		**261**	**111**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 4A would result in the permanent and temporary loss combined of up to 372 acres of modeled valley elderberry longhorn beetle habitat (72 acres of riparian habitat and 300 acres of nonriparian habitat), and an estimated 14 elderberry shrubs from water conveyance facilities, which represent potential habitat for the species (Table 12-4A-13). Due to the limitation of the habitat suitability model, the effects on modeled habitat are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. These losses would be a result of water conveyance facilities and transmission line construction, and establishment and use of RTM areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other project physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Implementation of the habitat protection and restoration contained in Alternative 4A and implementation of AMMs committed to would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 349 acres of modeled valley elderberry longhorn beetle habitat, composed of 61 acres of riparian habitat and 288 acres of nonriparian habitat (Table 12-4A-13). In addition, an estimated 14 shrubs could be removed as a result of conveyance facilities construction. As noted in Section 12.3.2.3, *Methods Used to Assess Species Effects*, elderberry shrubs were mapped in the DHCCP Conveyance Planning Area where accessible and thus the entire footprint of water conveyance facilities was not surveyed. In many cases, the data collected did not always specify the number of shrubs observed but rather the size class and a range of stem numbers. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 111 acres of modeled valley elderberry longhorn beetle habitat (24 acres riparian and 87 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, reusable tunnel material storage areas, geotechnical boring areas, temporary access roads, and staging areas.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 23 acres of modeled habitat (11 acres of riparian and 12 acres of nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of protected habitats for species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

- Operations and maintenance: Post-construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe the environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 372 acres of modeled valley elderberry longhorn beetle habitat (72 acres of riparian habitat and 300 acres of nonriparian habitat) (1% of the modeled habitat in the study area). These losses would not fragment any known populations of valley elderberry longhorn beetle.

Typical NEPA and CEQA project-level mitigation ratios for riparian habitat affected by the project would be 1:1 for restoration and 1:1 for protection of riparian habitat. Using these typical ratios would indicate that 72 acres of the riparian habitat should be restored/created and 72 acres of existing riparian should be protected to mitigate project losses of valley elderberry longhorn beetle habitat.

Alternative 4A includes a commitment to restore/create up to 251 acres of riparian habitat and protect up to 103 acres of riparian habitat and in the project area. The Resource Restoration and Performance Principles identified under Alternative 4A for valley elderberry longhorn beetle conservation include implementing the USFWS conservation guidelines for the species (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) (Resource Restoration and Performance Principle VELB1) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle (Resource Restoration and Performance Principle VELB2). These Resource Restoration and Performance Principles would be met through the implementation of *Environmental Commitment 7 Riparian Natural Community Restoration*. *Environmental Commitment 7 Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS conservation guidelines (U.S. Fish and Wildlife Service 1999a). The acres of riparian protection and restoration proposed would satisfy the typical mitigation requirements described in the previous paragraph. Though there are no restoration and preservation goals for the nonriparian habitat affected, the commitment to transplant shrubs and plant additional elderberry seedlings and associated natives would, together with the proposed restoration and protection of riparian (a higher quality habitat), would be more than adequate to compensate for the projects effects on the nonriparian habitat component of the modeled habitat for the species.

The project also includes commitments to implement AMM1 W*orker Awareness Training*, AMM2 C*onstruction Best Management Practices and Monitoring*, AMM3 *Stormwater Pollution Prevention Plan*, AMM4 *Erosion and Sediment Control Plan*, AMM5 *Spill Prevention, Containment, and Countermeasure Plan*, AMM6 *Disposal and Reuse of Spoils,* and AMM15 *Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites.

Other factors relevant to effects on valley elderberry longhorn beetle include:

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat, which is expected to result in a minimal effect on valley elderberry longhorn beetle because much of the riparian habitat in the project area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation would be moved to conservation areas in the project area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the project area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the

Environmental Commitments or other project activities that would result in temporary effects on natural communities.

NEPA Effects: In the absence of actions to compensate and avoid and minimize effects, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 4A would represent an adverse effect. However, with habitat protection and restoration associated with Environmental Commitment 7, Resource Restoration and Performance Principles VELB1 and VELB2, and by AMM1–AMM6, AMM10, and AMM15, the effects of Alternative 4A as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

CEQA Conclusion: Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, together with Resource Restoration and Performance Principles VELB1 and VELB2, implementation of Alternative 4A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle under CEQA.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, habitat restoration, and habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic post-construction disturbances with localized impacts on valley elderberry longhorn beetle. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis estimates that approximately 37 shrubs could be indirectly affected by conveyance facilities construction (see Section 12.3.2.3, *Methods Used to Assess Species Effects*, for a discussion of the methods used to make this estimate). Restoration activities could result in excavation or modification of channels, and type conversion from riparian and grasslands to other habitats, that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15.

NEPA Effects: With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 4A construction, operations, and maintenance, substantial adverse indirect effects on valley elderberry longhorn beetle would be avoided and minimized. The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 4A environmental commitments would not have an adverse effect on valley elderberry longhorn beetle under NEPA.

CEQA Conclusion: With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 4A construction, operation, and maintenance, substantial adverse indirect effects on valley elderberry longhorn beetle would be avoided and minimized. Furthermore, the impacts from project would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle under CEQA.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Alternative 4A

Alternative 4A would not result in periodic effects on valley elderberry longhorn beetle.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on nonlisted vernal pool invertebrates (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but do not include topographic depressions that are characteristic of vernal pools.

Alternative 4A would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-4A-14 and indirect conversions of vernal pool habitat. Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles that would benefit nonlisted vernal pool invertebrates.

- Protect up to 188 acres of existing vernal pool/alkali seasonal wetland complex (Environmental Commitment 3) in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principles VP/AW1)
- Restore vernal pool complex and alkali seasonal wetland suitable for vernal pool invertebrates to achieve no net loss of wetted acreage (Environmental Commitment 9, Resource Restoration and Performance Principles VP/AW2).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principles VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principles VP/AW4).

As explained below, with the restoration and protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would not be adverse for NEPA purposes and would be less-than significant for CEQA purposes.

Table 12-4A-14. Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary	Indirect
Water Conveyance Facilities	High-value (vernal pool complex and alkali seasonal wetland complex)	13	1	42
	Low-value (degraded vernal pool complex)	7	2	0
Total Impacts Water Conveyance Facilities		**20**	**3**	**41**
Environmental Commitments 4, 6–7, 9–11[a]	High-value (vernal pool complex and alkali seasonal wetland complex)	17	0	3
	Low-value (degraded vernal pool complex)	8	0	1
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**25**	**0**	**4**
TOTAL IMPACTS		**45**	**3**	**46**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 4A would result in the direct, permanent and temporary loss combined of 48 acres of vernal pool habitat from conveyance facilities construction and tidal restoration. In addition, conveyance construction and tidal restoration could result in the indirect conversion due to hydrologic alteration of an additional 46 acres of vernal pool complex. Construction of the water conveyance facilities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute an indirect effect unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place. Habitat enhancement and management activities (Environmental Commitment 11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

As specified in *AMM12 Vernal Pool Crustaceans* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, restoration projects would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent habitat restoration activities, in particular tidal restoration. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines avoid removal of wetted acres of vernal pools and alkali seasonal wetlands wetted acres of aquatic habitats to the maximum extent feasible. The term wetted acres refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involve an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 23 acres of vernal pool habitat, composed of 14 acres of high-value and 9 acres of low-value habitat (Table 12-4A-14). In addition, the conveyance facilities could result in the indirect conversion of 42 acres of vernal pool habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, from the storage of reusable tunnel material, and permanent access roads. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that temporary transmission lines are designed to avoid removal wetted acres of aquatic habitats to the maximum extent practicable. There are no records of these nonlisted vernal pool invertebrates at this location (California Department of Fish and Game 2013).

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Implementation would result in the conversion of an estimated 25 acres of modeled vernal pool habitat (17 acres of high-value and 8 acres low-value habitat). Tidal restoration would also result in the indirect conversion of an estimated 4 acres of modeled vernal pool habitat. The effects would take place in one or more of the ROAs established for tidal restoration (see Figure 12-1).

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Alternative 4A's restoration/creation of vernal pools to achieve no net loss and the protection of up to 188 acres of vernal pool/alkali seasonal wetland complex would benefit vernal pool invertebrates. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The proposed conservation efforts have been evaluated to determine whether they would provide sufficient habitat protection and restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4A-14 above lists the impacts on nonlisted vernal pool invertebrate habitat that are based on the natural community mapping done within the study area. Table 12-4A-15 was prepared to further analyze the project's effects on vernal pool invertebrates using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of habitat. Wetted acres were estimated by using the BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the project area, it is likely that the actual densities within the project area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4A-15. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 4A (acres)

	Direct Loss	Indirect Conversion
AMM 12 Impact Limit	10	20
Water Conveyance Facilities[a]	3.45	6.30
Environmental Commitments 4, 6–7, 9–11	3.75	0.60
Total	**7.2**	**6.9**

[a] These acreages were generated by assuming that the modeled habitat identified in Table 12-4A-14 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by Alternative 4A would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 7.2 wetted acres of vernal pool habitat (48 acres of vernal pool/alkali seasonal wetland complex) should be restored and 28.2 wetted acres of vernal pool habitat (188 acres of vernal pool/alkali seasonal wetland complex) protected to mitigate Alternative 4A's direct and indirect effects on nonlisted vernal pool species habitat. With the implementation of AMM30, the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay.

Project proponents would commit to protecting 188 acres of vernal pool/alkali seasonal wetland complex by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. Alternative 4A also includes a commitment to restore or create vernal pools such that the project would result in no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria, which would satisfy Resource Restoration and Performance Principle VP/AW2.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The protection and restoration would be achieved by implementation of the following the Resource Restoration and Performance Principles.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principles VP/AW1).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principles VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principles VP/AW4).

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM30 Transmission Line Design and Alignment Guidelines*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of vernal pool habitat under Alternative 4A would not be adverse under NEPA because project proponents would commit to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, and AMM30, which would be in place throughout the time period of construction and operations. Considering these commitments, losses and conversions of nonlisted vernal pool invertebrates habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on nonlisted vernal pool invertebrate habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of actions to compensate, avoid, and minimize impacts. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 9, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, and AMM30, which would be in place throughout the period of construction and operations. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 4A would have a less-than-significant impact on nonlisted vernal pool invertebrates under CEQA.

Impact BIO-39: Indirect Effects of Alternative 4A on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. Vernal pools could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into nonlisted vernal pool invertebrate habitat that occurs along the southern and western boundaries of the forebays.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. These potential effects would be avoided and minimized through AMM1–AMM6, and AMM10 which would be in effect throughout the period of construction and operations. The indirect effects of Alternative 4A on nonlisted vernal pool invertebrates would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout period of construction and operations. The indirect impacts of Alternative 4A on nonlisted vernal pool invertebrates would be less than significant under CEQA.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on nonlisted vernal pool invertebrates.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the Environmental Commitments, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes the inland dune scrub at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance construction would not affect inland dune scrub habitat at Antioch Dunes NWR. No dredge spoil areas that could be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 4A water intake facilities on aerial imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of Alternative 4A restoration measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the project area is at Antioch Dunes, which would not be impacted by the Alternative 4A Environmental Commitments. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of Alternative 4A restoration actions could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the project area; however the extent of these habitats in the project area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *Environmental Commitment 4 Tidal Natural Communities*

Restoration and *Environmental Commitment 6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Alternative 4A would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 4A Environmental Commitments would generally increase opportunities for the formation of sandbars in the project area.

- As stated in Environmental Commitment 6, 4.6 miles of channel margin habitat would be enhanced.
- Restore up to 251 acres of riparian habitat (Environmental Commitment 7).
- Protect up to 103 acres of riparian habitat (Environmental Commitment 3).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-16. Changes in Sacramento and Antioch Dunes Anthicid Beetles' Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	Unknown	Unknown
TOTAL IMPACTS	**Unknown**	**Unknown**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 4A Environmental Commitments could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the full extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of Google Earth imagery in the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery in the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the project area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Environmental Commitments that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal habitat restoration (Environmental Commitment 4) and channel margin enhancement (Environmental Commitment 6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The methods and techniques for tidal restoration may include the recontouring of lands so that elevations are suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 4.6 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 4A could result in substantial effects on Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which may be considered for tidal restoration (Environmental Commitment 4). Furthermore, three of the records for Sacramento anthicid beetle within the study area fall within areas being considered for tidal restoration (Environmental Commitment 4), which represents approximately one quarter of the extant records for this species range wide (3 of 13). The only extant record for Antioch Dunes anthicid beetle, which represents one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected if tidal restoration occurs in these areas. However, considering all of the Environmental Commitments under Alternative 4A, Sacramento and Antioch Dunes anthicid beetles would likely benefit from the project. Under Alternative 4A, Environmental Commitment 6, and Environmental Commitment 7, would generally contribute to the formation of sandbar habitat in the project area. These measures would improve shoreline conditions by creating benches along levees (Environmental Commitment 6) and increasing shoreline vegetation (Environmental Commitment 7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form.

NEPA Effects: The potential impacts on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 4A as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other means to compensate for, avoid, and/or minimize impacts. However, considering the implementation of restoration associated with Environmental Commitment 6 and Environmental Commitment 7 the effects of Alternative 4A as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

CEQA Conclusion: Alternative 4A would potentially impact Sacramento and Antioch Dunes anthicid beetles' habitat and could impact three occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, the implementation of the Environmental Commitments would likely benefit Sacramento and Antioch Dunes anthicid beetles. Environmental

Commitment 6 and Environmental Commitment 7 would generally contribute to the formation of sandbar habitat in the project area. Alternative 4A as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than-significant impact on Sacramento and Antioch Dunes anthicid beetles under CEQA.

Delta Green Ground Beetle

Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 4A could affect delta green ground beetle through the potential protection of grasslands (Environmental Commitment 3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions (Environmental Commitment 11) in these areas. In addition, tidal natural communities restoration (Environmental Commitment 4) and vernal pool and alkali seasonal wetland complex restoration (Environmental Commitment 9) could result in potential impacts on delta green ground beetle and its habitat. Alternative 4A could result in beneficial effects on delta green ground beetle through the protection of grasslands it occurs in CZ 1.

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4A-17. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	Unknown	Unknown
TOTAL IMPACTS	**Unknown**	**Unknown**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 4A Environmental Commitments could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Environmental Commitments that could affect delta green ground beetle include tidal natural communities habitat restoration (Environmental Commitment 4), vernal pool and alkali seasonal wetland complex restoration (Environmental Commitment 9),and habitat enhancement and management activities (Environmental Commitment 11) in CZ 1. CZ 1 is the only portion of the project area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; U.S. Fish and Wildlife Service 2009a). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. The tidal restoration methods and techniques identified in Environmental Commitment 4 include excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affect delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species.

- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool restoration may occur in CZ 1 and could result in disturbance to delta green ground beetle habitat if restoration is implemented in areas known to be or potentially occupied by the species. These restoration activities would most likely take place in areas that were historically vernal pool complexes that have since been highly degraded, but which are suitable for vernal pool restoration. These areas would not likely provide habitat for delta green ground beetle. However, if these activities take place in areas more suitable, then disturbances could result in direct mortality of the species. Nevertheless, restoration ultimately would expand habitat available to the species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Grasslands would potentially be protected in CZ 1. Potential effects from Environmental Commitment 11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species.

NEPA Effects: The potential protection of grassland in CZ 1 (Environmental Commitment 3) could benefit delta green ground beetle if these areas occur within the range of the species. Tidal natural communities restoration (Environmental Commitment 4), and vernal pool and alkali seasonal wetland complex restoration (Environmental Commitment 9) could impact delta green ground beetle. The management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and Management* has a potential to affect this species. Direct mortality and the affects on delta green ground beetle habitat would be an adverse effect under NEPA. Implementation of mitigation measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce this effect.

CEQA Conclusion: The implementation of grassland protection (Environmental Commitment 3), tidal natural communities restoration (Environmental Commitment 4), and vernal pool and alkali seasonal wetland complex restoration (Environmental Commitment 9) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from Environmental Commitment 11 could include direct mortality to larvae and adults resulting from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and therefore result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce these potential impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design and development of management plans for conservation areas in the area of Jepson Prairie, the project proponents will implement the following measures to avoid effects on delta green ground beetle.

- If habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.
- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and all ground disturbing activities in these areas will be avoided, which for the project area is generally the area west of State Route 113.
- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing activities will be implemented in areas identified as occupied by delta green ground beetle.
- Based on the results of the habitat evaluations and surveys and site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

This section describes the effects of Alternative 4A on callippe silverspot butterfly. Suitable habitats are typically in areas influenced by coastal fog with hilltops that support the specie's host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldenaster, coast buckwheat, mourning bride, and California buckeye. Suitable habitat in the study area is located in CZ 11 in the Cordelia Hills west of I-680 and in the Potrero Hills on the northern edge of Suisun Marsh. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* and the subsequent implementation of *Environmental Commitment 11 Natural Communities Enhancement and Management,* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the project area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Alternative 4A would protect up to 1,060 acres of grassland, some of which may occur in areas in CZ 11 that contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4A-18. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	Unknown	Unknown
TOTAL IMPACTS	**Unknown**	**Unknown**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 4A Environmental Commitments could result in the conversion of habitat and/or direct mortality to callippe silverspot butterfly. Only one Environmental Commitment was identified as potentially affecting Callippe silverspot butterfly, *Environmental Commitment 11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *Environmental Commitment 3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

Up to 1,060 acres of grasslands would be protected in the project area, some of which may occur in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from Environmental Commitment 11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

NEPA Effects: The protection of up to 1,060 acres of grassland some of which may occur within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. However, the management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and*

Management also has a potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse under NEPA.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and Management* has a potential to affect this species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would therefore result in significant impact on the species under CEQA. However, callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and thus reduce the potential impact to a less-than-significant level under CEQA.

Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, project proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.
- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by project actions.

Alternative 4A would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-4A-19. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11.

Alternative 4A would include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit the California red-legged frog.

- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect up to 647 acres of grassland in the Byron Hills area where practicable and/or in other appropriate locations (Environmental Commitment 3, Resource Restoration and Performance Principle G10).
- Protect up to 188 acres and restore up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitment 3, Environmental Commitment 9, and Resource Restoration and Performance Principle VP/AW1) with the grassland portions expected to benefit California red-legged frog.
- Increase burrow availability for burrow-dependent species in grasslands surrounding all suitable aquatic habitat including stock ponds and vernal pool/alkali seasonal wetland complexes (Resource Restoration and Performance Principles G5, VP/AW6).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in protected grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs to reduce potential effects, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-19. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic	1	0
	Upland	21	32
Total Impacts Water Conveyance Facilities		**22**	**32**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic	0	0
	Upland	11	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**11**	**0**
TOTAL IMPACTS		**33**	**32**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 4A water conveyance facilities construction and Environmental Commitments would result in the permanent and temporary loss combined of up to 1 acre of modeled aquatic habitat and 64 acres of modeled upland habitat for California red-legged frog (Table 12-4A-19). Construction activities associated with the water conveyance facilities, including operation of construction equipment, could result in permanent and temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A would result in the permanent loss of up to 1 acre of aquatic habitat and 21 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-4A-19). Permanent effects would be associated with RTM, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California red-legged frog (Table 12-4A-19). Although there are no California red-legged frog occurrences that overlap with the water conveyance facilities construction footprint there are a number of occurrences approximately 0.5 mile to the west of Clifton Court Forebay.

- *Environmental Commitment 11 Natural Communities Enhancement and Management* Protection of up to 647 acres of grassland, protection of up to 188 acres and restoration of up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands, and protection and restoration of up to 6 acres of aquatic habitat would benefit California red-legged frog. Activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs discussed below. Herbicides would only be used in

California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog. *AMM14 California Red-Legged Frog* would be implemented to ensure that California red-legged frog upland and aquatic habitats are avoided, as described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

- Critical habitat: Several Environmental Commitments would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Environmental Commitments to protect and enhance grassland habitat for wildlife species, including California red-legged frog in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation environmental commitments and AMM1–AMM6, AMM10, and AMM14 would reduce these effects.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, stock pond and vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, and AMM14.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are approximately 159 acres of modeled aquatic habitat and 7,766 acres of modeled upland habitat for California red-legged frog in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 64 acres of upland habitat for California red-legged frog (less than 1% of the total aquatic habitat and total upland habitat in the study area).

These effects would result from construction of the water conveyance (54 acres) and other facilities (11 acres). The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

With full implementation of Alternative 4A up to 647 acres of grassland would be protected, 188 acres of vernal pool/alkali seasonal wetland complexes with associated grasslands would be protected and 48 acres would be restored, and up to 6 acres of aquatic habitat would be protected and restored in the greater Byron Hills in CZ 8. Protection of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas. Six acres of ponds in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs. Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in Environmental Commitment 11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 128 acres of grassland should be protected for California red-legged frog.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM14 California Red-Legged Frog*. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on California red-legged frog habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, and AMM14, which would be in place throughout the construction period, the effects of Alternative 4A as a whole on California red-legged frog would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on California red-legged frog habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, and AMM14, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on California red-legged frog would be less than significant.

Impact BIO-45: Indirect Effects of Alternative 4A on California Red-Legged Frog

Noise and visual disturbance including aritifical nighttime lighting outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted by DWR in this area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, and AMM14 as part of implementing Alternative 4A would avoid the potential for adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on California red-legged frog.

CEQA Conclusion: Indirect effects from Environmental Commitment operations and maintenance, as well as construction-related noise and visual disturbances including artificial nighttime lighting, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, and AMM14, Alternative 4A construction, operation, and maintenance would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 4A would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

California tiger salamander occurs within the study area in CZ 8 west of Clifton Court Forebay and in CZ 11 in the Potrero Hills (Figure 12-14). Potential habitat exists in vernal pool habitats in Yolo and Solano Counties (CZs 1, 2, and 3) west of Liberty Island and in the vicinity of Stone Lakes and the Cosumnes River Preserve in Sacramento County (CZ 4). DWR found California tiger salamander west of Clifton Court Forebay in the same vicinity as several of the CNNDB (California Department of Fish and Wildlife 2013) records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). There is also a small, isolated population near Manteca, south of Highway 120 in CZ 7.

Construction and restoration associated with Alternative 4A would result in temporary and permanent losses of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-4A-20). Potential aquatic habitat for this species would not be affected. Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While Environmental Commitments implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 4A would include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit the California tiger salamander (see Chapter 3, *Conservation Strategy*, of the BDCP).

- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect up to 647 acres of grassland in the Byron Hills area where practicable and/or in other appropriate locations (Environmental Commitment 3, Resource Restoration and Performance Principle G10).
- Protect up to 188 acres and restore up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitment 3,Environmental Commitment 9, and Resource Restoration and Performance Principle VP/AW1).

- Increase burrow availability for burrow-dependent species in grasslands surrounding all suitable aquatic habitat including stock ponds and vernal pool/alkali seasonal wetland complexes (Resource Restoration and Performance Principles G5, VP/AW6).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in protected grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).
- Increase the size and connectivity of protected vernal pool complex within the project area and increase connectivity with protected vernal pool complex adjacent to the project area (Resource Restoration and Performance Principle VP/AW3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-20. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic	0	0
	Upland	19	32
Total Impacts Water Conveyance Facilities		**19**	**32**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic	17	0
	Upland	41	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**58**	**0**
TOTAL IMPACTS		**77**	**32**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 4A would result in the permanent and temporary loss combined of up to 17 acres of aquatic habitat and 92 acres of modeled upland habitat for California tiger salamander (Table 12-4A-20). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM and tidal restoration. In addition, natural enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could degrade or eliminate California tiger salamander habitat including injury and mortality of California tiger salamanders. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities, including transmission lines, would result in the permanent loss of 19 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-4A-20). No aquatic habitat would be affected. Permanent effects would be associated with RTM, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California tiger salamander (Table 12-4A-20). There is one California tiger salamander occurrence just south of the City of Byron that overlaps with the area of temporary effects. The area that would be affected by conveyance facilities construction is south of Clifton Court Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent removal of an estimated 17 acres of aquatic and 24 acres of upland habitat for California tiger salamander. The effects would take place in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of up to 647 acres of grassland, protection of up to 188 acres and restoration of up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands, and protection and restoration of up to 6 acres of aquatic habitat would benefit California tiger salamander. Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values. Activities associated with natural communities enhancement and management in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, and AMM13 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.
- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by project restoration actions.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding

habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, and AMM13.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, stock pond and vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, and AMM13.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

There are approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander in the study area. Alternative 4A as a whole would result in the permanent loss of, and temporary effects combined on 17 acres of aquatic and 92 acres of upland habitat for California tiger salamander for the term of the plan (less than 1% of the total upland habitat in the study area). These effects would result from construction of the water conveyance facilities and tidal restoration.

With full implementation of Alternative 4A up to 647 acres of grassland would be protected, 188 acres of vernal pool/alkali seasonal wetland complexes with associated grasslands would be protected and 48 acres would be restored, and up to 6 acres of aquatic habitat would be protected and restored in the greater Byron Hills in CZ 8. Protection of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas. Six acres of ponds in the grasslands would also be protected or restored to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders. Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in Environmental Commitment 11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 17 acres of aquatic habitat should be restored, 17 acres of aquatic habitat should be protected, and 184 acres of grassland should be protected for California tiger salamander.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM13 California Tiger Salamander*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on California tiger salamander habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW3, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, and AMM13, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on California tiger salamander would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on California tiger salamander habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW3, VP/AW6, G2, G7, and G10, and by AMM1–AMM6, AMM10, and AMM13, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on California tiger salamander would be less than significant.

Impact BIO-47: Indirect Effects of Alternative 4A on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conveyance construction, restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances, including aritifical night lighting at a worksite. Most of the areas indirectly affected are associated with the construction of Byron Forebay in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, and AMM13 under Alternative 4A would avoid or minimize the potential for adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects resulting from project operations and maintenance as well as construction-related noise and visual disturbances including artificial night lighting could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, and AMM13 as part of Alternative 4A, the project would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 4A would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on California tiger salamander.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Giant Garter Snake

The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic, tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 4A would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-4A-21. Alternative 4A would include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit the giant garter snake.

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitment 3 and Environmental Commitment 8).
- Protect up to 843 acres of high-value upland giant garter snake habitat adjacent to suitable aquatic habitat (Environmental Commitment 3, Resource Restoration and Performance Principle GGS4).
- Restore up to 255 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle in CZ 4 and CZ 5 (Environmental Commitment 10).
- Protect up to 11,870 acres of cultivated lands that provide suitable habitat for native wildlife species, of which 255 acres of rice land or equivalent-value habitat would be protected for giant garter snake and connected to the restored 255 acres of aquatic habitat in nontidal marsh for giant garter snake in CZ 4 or CZ 5 (Environmental Commitment 3, Resource Restoration and Performance Principles GGS1 and GGS3).
- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2)
- Target cultivated land conservation to provide connectivity between other conservation lands (Resource Restoration and Performance Principle CL2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake conservation area at least 2,500 feet from urban areas or areas zoned for urban development (Resource Restoration and Performance Principle GGS2).
- Create connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting 255 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 255 acres may consist of muted tidal freshwater emergent wetland and may overlap with the 160 acres of tidally restored freshwater emergent wetland if

it meets specific giant garter snake habitat criteria (Resource Restoration and Performance Principle GGS5).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-21. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type[b]	Permanent	Temporary
Water Conveyance Facilities	Aquatic (acres)	210	110
	Upland (acres)	408	206
	Aquatic (miles)3	11	6
Total Impacts Water Conveyance Facilities (acres)		**618**	**316**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic (acres)	3	0
	Upland (acres)	46	0
	Aquatic (miles)	2	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a] (acres)		49	0
TOTAL IMPACTS (acres)		**667**	**316**

[a] See discussion below for a description of applicable Environmental Commitments.
[b] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 4A would result in the permanent and temporary loss combined of up to 323 acres of modeled aquatic habitat (tidal and nontidal combined), up to 660 acres of modeled upland habitat, and up to 19 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-4A-21). Project measures that would result in these losses are water conveyance facilities and transmission line construction, geotechnical investigation, and establishment and use of RTM and tidal restoration. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities would degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 618 acres of modeled giant garter snake habitat, composed of 210 acres of aquatic habitat and 408 acres of upland habitat (Table 12-4A-21). The 408 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 116 acres of high-, 262 acres of moderate-, and 30 acres of low-value habitat. In addition, approximately 11 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 110 acres of giant garter snake aquatic habitat and up to 206 acres of adjacent upland habitat in areas near construction and geotechnical investigation in CZ 5 and CZ 6 (see Table 12-4A-21 and Terrestrial Biology Mapbook). In addition, approximately 6 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction. There are three giant garter snake occurrences in the vicinity of the water conveyance facilities construction footprint in Snodgrass Slough and Middle River.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in an estimated permanent loss of approximately 3 acres of aquatic habitat and 46 acres of upland habitat for the giant garter snake to tidal marsh. This estimate includes 15 acres of high-value, 27 acres of moderate-value, and 4 acres of low-value habitat. In addition, an estimated 2 miles of channels providing giant garter snake movement habitat would be removed as a result of tidal natural communities restoration. The effects would take place in one or more of the ROAs established for tidal restoration (see Figure 12-1).

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. These effects cannot be quantified, but are expected to be minimal because vegetation removal would occur around existing infrastructure and roads where giant garter snake are not as likely to be present. Any of these minor impacts would be avoided and minimized by the AMMs listed below.

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 3, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and environmental commitments as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the Coldani Marsh/White Slough subpopulation [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated construction and restoration could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A Environmental Commitments that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are approximately 31,281 acres of aquatic and 53,285 acres of upland modeled habitat for giant garter snake in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 323 acres of aquatic habitat and 660 acres of upland habitat for giant garter snake during the term of the plan (1% of the total aquatic and upland modeled habitat in the study area).

With full implementation of Alternative 4A there would be protection of up to 1,060 acres and restoration of up to 1,070 acres of grassland, protection of up to 11,870 acres of cultivated lands, 119 acres of nontidal wetlands, and restoration of up to 832 acres of nontidal wetlands in the study area. Lands to be protected and restored specifically for the giant garter snake total 1,353 acres (255 acres nontidal marsh, 843 acres of grassland, 255 acres of cultivated lands (rice or habitat of equivalent value in CZ 4, and CZ 5). In addition to the 1,353 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration and protection of garter snake habitat. An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the conservation area, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands.

Protection and management of cultivated lands (Environmental Commitment 11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Giant garter snake habitat would be restored and protected specifically to conserve and expand the Coldani Marsh/White Slough subpopulation of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the study area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the study area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 323 acres of aquatic habitat should be restored, 323 acres of aquatic habitat should be protected, and 1,320 acres of upland habitat should be protected for giant garter snake.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM16 Giant Garter Snake*. All of these AMMs include elements that avoid or minimize the risk of activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, and AMM16, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on giant garter snake would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, and AMM16, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on giant garter snake would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50: Indirect Effects of Alternative 4A on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, habitat restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, and AMM16, which would be in effect during all project activities.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Project activities have the potential to exacerbate bioaccumulation of mercury in species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under water conveyance facilities were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see BDCP Appendix 5.D, *Contaminants).*

Marsh (tidal and nontidal) restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes. Thus, restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with minimization and mitigation measures and adaptive management and monitoring, *Environmental Commitment 12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Yolo Basin is where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008); however, there would be no construction or restoration in this area. Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *Environmental Commitment 12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, Environmental Commitment 12 is expected to reduce the effects of methylmercury resulting from natural communities and floodplain restoration on giant garter snake.

***NEPA Effects*:** Implementation of the AMMs listed above and *Environmental Commitment 12 Methylmercury Management* as part of implementing Alternative 4A would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs and Environmental Commitment would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on giant garter snake.

***CEQA Conclusion*:** Indirect effects from project operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, and AMM16 and *Environmental Commitment 12 Methylmercury Management* as part of Alternative 4A construction, operation and maintenance, the project would avoid or minimize the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Therefore, the indirect effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 4A would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes NWR, and the Delta in the study area.

NEPA Effects: Alternative 4A would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes NWR, and the Delta in the study area.

CEQA Conclusion: Alternative 4A would have a less-than-significant impact on connectivity among giant garter snakes in the study area and therefore no mitigation is required.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on giant garter snake.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in BDCP Appendix 2.A, *Species Accounts*, Section 2A.29, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Alternative 4A would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-4A-22. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area.

Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles to benefit the western pond turtle.

- Protect up to 103 acres and restore up to 251 acres of valley/foothill riparian habitat (Environmental Commitments 3 and 7).
- Protect up to 119 acres and restore up to 832 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will include suitable habitat characteristics for western pond turtle (Environmental Commitments 3 and 10, Resource Restoration and Performance Principle WPT1).
- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitments 3 and 8).

- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-22. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic (acres)	335	2,005
	Upland (acres)	261	84
	Aquatic (miles)	7	4
Total Impacts Water Conveyance Facilities (acres)		**596**	**2,089**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic (acres)	231	0
	Upland (acres)	38	0
	Aquatic (miles)	2	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a] (acres)		**269**	
TOTAL IMPACTS (acres)		**865**	**2,089**

[a] See discussion below for a description of applicable Environmental Commitments.
[b] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 4A would result in the permanent and temporary loss of up to 2,363 acres of aquatic habitat and 383 acres of upland nesting and overwintering habitat (Table 12-4A-22). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, geotechnical investigations, and establishment and use of RTM, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western pond turtle habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- Water Facilities and Operation: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 335 acres of aquatic habitat and 261 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-4A-22). Development of the water conveyance facilities would also result in the temporary removal of up to 2,005 acres of aquatic habitat and 84 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-4A-22). Approximately 7 miles of channels providing western pond turtle movement habitat would be removed and 4 miles would be temporarily disturbed. There are four western pond turtle occurrences that overlap with the water conveyance facilities footprint in CZ 2, one occurrence that overlaps with an RTM area on the southern tip of Bouldin Island in CZ 5, and one occurrence that overlaps with an RTM area along Twin Cities Road in CZ 4.

Permanent effects on an estimated 162 of the total 596 aquatic and upland acres combined and 4 of the 7 miles would be lost as storage areas for RTM, which would likely be moved to other sites for use in levee build-up and restoration. The affected area would likely be restored. Although this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. Furthermore, the amount of storage area needed for RTM is flexible and the footprint used in the effects analysis is based on a worst case scenario. The actual area to be affected by RTM storage would likely be less than the estimated acreage.

The majority of the permanent loss of aquatic habitat and upland nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high-value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. Although there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect would be widely dispersed because of the long, linear nature of the pipeline footprint.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of an estimated 23 acres of aquatic habitat and 38 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration is likely to create suitable, slow-moving freshwater slough and marsh habitat suitable for western pond turtle. The effects would take place in one or more of the ROAs established for tidal restoration (see Figure 12-1). Actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values. In addition, effects would be avoided and minimized by the AMMs listed below.

- Operations and maintenance: Ongoing maintenance of facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and environmental commitments described below.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where Environmental Commitments are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic or upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Based on the habitat model, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 4A as a whole would remove 2,363 acres of aquatic habitat and 383 acres of upland nesting and overwintering habitat for western pond turtle (3% of the total aquatic habitat and 1% of the total upland habitat in the study area).

These effects would result from water conveyance facilities construction (2,340 acres of aquatic and 345 acres of upland habitats), tidal habitat restoration (Environmental Commitment 4, 23 acres of aquatic and 38 acres of upland habitat). Most of the impacts (2,005 acres) from water conveyance facilities would be temporary in the vicinity of Clifton Court Forebay and are expected to return to suitable aquatic habitat once construction is completed. Therefore the following analysis addresses the permanent loss of 358 acres of aquatic habitat.

Implementation of Alternative 4A as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected conservation area that provides for western pond turtle dispersal. The project proponents have committed to protection and restoration of up to 957 acres of aquatic habitat including 951 acres of nontidal wetland and up to 6 acres of stock ponds. In addition, there would be 354 acres of valley/foothill riparian habitat and 2,130 acres of grasslands habitat. The most beneficial restoration would occur in the 832 acres of freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland of which 77 acres would be protected and 77 acres restored with suitable habitat characteristics for western pond turtle. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 11,870 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species and to help offset the loss of aquatic habitat. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected for western pond would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 358 acres of aquatic habitat should be restored, 358 acres of aquatic habitat should be protected, and 766 acres of upland habitat should be protected for western pond turtle. Alternative 4A also contains commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities, and AMM17 Western Pond Turtle*. These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on western pond turtle would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles WPT1, G2, and CL1, and guided by AMM1–AMM6, AMM10, AMM17, and AMM 37, the effects of Alternative 4A as a whole on western pond turtle would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on western pond turtle habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles WPT1, G2, and CL1, and guided by AMM1–AMM6, AMM10, and AMM17, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on western pond turtle would be less than significant.

Impact BIO-53: Indirect Effects of Alternative 4A on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting and overwintering habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, habitat restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and

AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

NEPA Effects: With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4A, the project would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on western pond turtle.

CEQA Conclusion: Indirect effects resulting from project operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4A construction, operation, and maintenance, Alternative 4A would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 4A would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on western pond turtle.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 4A on the silvery legless lizard, San Joaquin coachwhip and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10) (Figure 12-17). There are isolated patches of sandy habitat in the vicinity of Oakley and along the railroad in the East Bay Regional Park Legless Lizard Preserve that are not shown in Figure 12-17 because project mapping was not available at this level of detail. Furthermore, none of these areas would be affected by construction or restoration activities and this species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the whipsnake in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4). Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013).

In addition, historic museum records show that Blainville's horned lizard occurrences could have been extirpated within the study area (Jennings and Hayes 1994).

Construction associated with Alternative 4A Environmental Commitments would result in both temporary and permanent removal of habitat that special-status reptiles use for cover and dispersal (Table 12-4A-23).

Alternative 4A would also include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit special-status reptiles.

- Increase the size and connectivity of the conservation area by acquiring lands adjacent to and between existing conservation lands (Resource Restoration and Performance Principle L1).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect up to 188 acres and restore up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitments 3 and 9).
- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitments 3 and 8).
- Increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (G4).
- Increase burrow availability for burrow-dependent species (G5)
- Increase prey abundance and accessibility, especially of small mammals and insects, for grassland-foraging species (G6)

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-23. Changes in Special-Status Reptile Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type[b]	Permanent	Temporary
Water Conveyance Facilities	Grassland	269	102
Total Impacts Water Conveyance Facilities		**269**	**102**
Environmental Commitments 4, 6–7, 9–11[a]	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**269**	**102**

[a] See discussion below for a description of applicable Environmental Commitments.
[b] Grassland impacts include alkali seasonal wetland complex, grassland, and inland dune scrub natural communities.

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 4A would result in the permanent and temporary loss of 371 acres of habitat for special-status reptiles (Table 12-4A-23). Water conveyance facilities and transmission line construction, including establishment and use of RTM and geotechnical investigations would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (Environmental Commitment 11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effect are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though this assumption results in slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4 where it does not occur.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to Environmental Commitments could have similar effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 269 acres of habitat for special-status reptiles in the vicinity of Clifton Court Forebay. Construction-related effects would temporarily disturb 102 acres of suitable habitat for special-status reptiles in the study area. There are no occurrences of either species within the construction footprint for water conveyance facilities.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *Environmental Commitment 11* that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species habitat values. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55 *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs.*
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55*.*
- Injury and direct mortality: Construction vehicles may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and

maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. However, the risk of crushing Blainville's horned lizard would not necessarily be lower during the active season, because the species uses crypsis to hide from predators and would be hard to spot from a moving vehicle. Seasonal risk reduction may be more appropriate for the coachwhip, but there is still a risk of crushing the horned lizard during the active season. In addition, both species would not be active under conditions of extreme temperatures and could be taking cover in burrows or crevices or under structures such as rocks or logs (Morey 2000). They could also burrow beneath the soil and be crushed by vehicles. Increased vehicular traffic associated with project actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible, and when temperatures are 67–100 degrees F, and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Alternative 4A would remove 371 acres of grassland habitat for special-status reptiles as a result of water conveyance facilities.

Effects of water conveyance facilities construction on special-status reptiles would be offset through the project's protection of up to 1,060 acres and restoration of up to 1,070 acres of grassland, and grassland associated with protection and restoration of up to 198 acres of vernal pool/alkali seasonal wetland complex. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8. This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP. The projects commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of vernal pool/alkali seasonal wetland complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

The typical NEPA and CEQA project-level mitigation ratio (2:1 for protection) for this natural community would indicate that 742 acres should be protected to offset water conveyance facilities losses.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on special-status reptile habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L1-L3, and by Mitigation Measure BIO-55, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on special-status reptiles would not be an adverse effect.

CEQA Conclusion: In the absence of other actions to restore and protect habitat, the effects on special-status reptile habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L1-L3, and by Mitigation Measure BIO-55, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on special-status reptiles would be less than significant.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in construction and restoration areas that are relatively undisturbed or have a moderate to high potential to support Blainville's horned lizard and San Joaquin coachwhip in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for these reptiles in areas of suitable habitat concurrent with the preconstruction surveys for other special-status species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are found in work areas, the biologist will first attempt to allow these species to move out of the work area on their own but if conditions do not allow this, individuals will be captured by the biologist and relocated to the nearest suitable habitat outside of the work area as determined in consultation with CDFW. To the extent feasible, work in areas with suitable habitat for Blainville's hornzed lizard and San Joaquin coachwhip should not be conducted during periods of cold and hot temperatures (below 67 degrees F and above 100 degrees F), because both species would be relatively inactive during these periods and could be taking cover in loose soil, in burrows or crevices, or under structures such as rocks or logs (Morey 2000). This would reduce the impact of being crushed by vehicles and equipment.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*, will be implemented for all special-status reptiles adversely affected by the project to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Alternative 4A on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, Environmental Commitments, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat.

In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of AMM10. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4A on special-status reptiles would not be adverse under NEPA.

CEQA Conclusion: Indirect effects from project operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present. These activities could result in a significant impact.

With implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* as part of Alternative 4A construction, operation, and maintenance, the project would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4A would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.

California Black Rail

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on California black rail. The habitat model used to assess effects for the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta includes all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat includes all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones that provide refugia during high tides within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Alternative 4A would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-4A-24. Full implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles that would benefit the California black rail.

- At the ecotone that would be created between restored tidal wetlands and transitional uplands (Environmental Commitment 4), provide for at least 13.5 acres of California black rail habitat (*Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres at a location subject to CDFW approval) consisting of shallowly inundated emergent vegetation at the upper edge of the marsh (within 50 meters of upland refugia habitat) with adjacent riparian or other shrubs that will provide upland refugia, and other moist soil perennial vegetation. If feasible, create the 13.5 acres of tidal habitat in a single patch in a location that is contiguous with occupied California black rail habitat (Resource Restoration and Performance Principle CBR1).
- Create topographic heterogeneity in restored tidal wetlands (Environmental Commitment 4, Resource Restoration and Performance Principle CBR2).

California black rail is a fully protected species and take of California black rail individuals is prohibited under Fish and Game Code Section 3511. With the implementation of *AMM38 California Black Rail*, construction activities would not result in take and effects on the species would be avoided. As explained below, with the restoration and protection of tidal wetland habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM38 California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-24. Changes in California Black Rail Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	0.5	11
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**0.5**	**11**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	1	0
	Secondary	1	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**2.5**	**11**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 4A would result in the combined permanent and temporary loss of 13.5 acres of modeled primary habitat for California black rail (Table 12-4A-24). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM areas. Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other Alternative 4A physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of up to 0.5 acres and the temporary loss of up to 11 acres of modeled primary California black rail habitat (Table 12-4A-24). The construction of a temporary transmission line in the central Delta that extends from Bouldin Island to Victoria Island would impact modeled habitat on Mandeville Island, the north end of Bacon Island, and on in-channel islands along the transmission line alignment. Other temporary impacts on modeled habitat would result from a temporary barge unloading facility and a temporary access road along the north end of Bacon Island, and from a temporary work area on Mandeveille Island. Geotechnical exploration could also impact black rail habitat on an in-channel island east of Bacon Island. Less than 0.5 acres of habitat would be permanently lost from the construction of a permanent transmission line at the northeast corner of Clifton Court Forebay in CZ 8. The water conveyance facilities footprint intersects with one California black rail occurrence on Mandeville Island, from the footprint of the temporary transmission line.

  Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Up to 2 acres of California black rail modeled habitat (1 acre of primary habitat and 1 acre of secondary habitat) would be affected by tidal marsh restoration. The restoration of up to 13.5 acres of tidal wetlands would benefit California black rail. The primary habitat for the species in the Delta consists of in-channel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under Environmental Commitment 4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration for the California black rail would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions associated with natural communities enhancement, that are designed to enhance wildlife values in restored tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3B, *Environmental Commitments, AMMs, and CMs*). The implementation of *AMM38 California Black Rail* would avoid disturbance and take by requiring restrictions on construction activities during the breeding season and establishing nodisturbance buffers around California black rail territories. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited. Environmental Commitment 11 would also include the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation on California black rail if needed.

  Water Facility Operations and Maintenance: Post construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the central Delta.

Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Injury and Direct Mortality: California black rail is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If rails are present adjacent to project activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or take of California black rail. Increased vehicular traffic associated with construction and maintenance of water conveyance facilities could also contribute to a higher potential for take. The implementation of *AMM38 California Black Rail* would avoid disturbance and take of California black rail individuals by restricting construction activities during the breeding season and establishing 500-foot no-disturbance buffers around identified territorial calling centers. If the 500-foot buffer does not provide complete avoidance of take, a CDFW-approved biologist would monitor construction activities to ensure that black rail individuals are not harmed. If breeding territories cannot be accurately delimited construction would not occur in order to avoid impacts (*AMM38 California Black Rail* is described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 4A would result in the permanent loss of 2.5 acre and temporary effects on up to 11 acres of primary California black rail habitat (much less than 1% of the total primary habitat in the study area) as a result of water conveyance facilities construction. The typical NEPA and CEQA project-level mitigation ratio for the tidal wetlands that would be affected by the project would be 1:1 for restoration/creation of tidal wetlands. Using this ratio would indicate that 13.5 acres of tidal freshwater emergent wetland should be restored/created to mitigate the losses of California black rail habitat.

The project includes measures to improve habitat for California black rail to offset the habitat that is permanently and temporarily lost. Conservation commitments under Alternative 4A through *Environmental Commitment 4 Tidal Natural Communities Restoration* would restore or create up to 13.5 acres of tidal wetlands at a location subject to CDFW approval.

Upland refugia for California black rail would be created between the restored tidal wetlands and transitional uplands to provide cover from predators (*Environmental Commitment 4 Tidal Natural Communities Restoration*/Resource Restoration and Performance Principle CBR1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *Environmental Commitment 11 Natural Communities Enhancement and Management*. These wetlands would consist of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre, which would provide primary habitat for the black rail. If feasible, the 13.5 acres of tidal restoration would occur in a single patch at a location adjacent to occupied California black rail habitat. Upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Environmental Commitment 4/Resource Restoration and Performance Principle

CBR1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *Environmental Commitment 11 Natural Communities Enhancement and Management*.

The project also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on California black rail: *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. *AMM38 California Black Rail* requires surveys for California black rail and the implementation of avoidance and minimization measures including the establishment of a 500 foot no disturbance buffer around any identified calling stations. All of these AMMs include elements that avoid or minimize the risk of affecting habitat and avoid the risk of take of California black rail in or adjacent to work areas and RTM storage sites.

NEPA Effects: In the absence of Environmental Commitments and AMMs, the losses of California black rail habitat and potential for take of a special-status species associated with Alternative 4A would represent an adverse effect. However, with habitat protection and restoration associated with Environmental Commitment 4, guided by Resource Restoration and Performance Principles CBR1 and CBR2, and AMM1–AMM7 and *AMM38 California Black Rail*, the effects of Alternative 4A as a whole on California black rail would not be adverse under NEPA.

CEQA Conclusion: In the absence of Environmental Commitments and AMMs, the losses of California black rail habitat and potential for take of a special-status species associated with Alternative 4A would represent a significant impact. Considering the restoration provisions, which would provide acreages of new tidal marsh habitat in amounts necessary to compensate for habitats lost to construction and restoration activities guided by Resource Restoration and Performance Principles CBR1 and CBR2, and the implementation of AMM1–AMM7 and *AMM38 California Black Rail*, implementation of Alternative 4A as a whole would not result in a substantial adverse effect through habitat modifications and would avoid take of California black rail individuals. Therefore, the alternative would have a less-than-significant impact on California black rail under CEQA.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

A variety of rail species are known to suffer take from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et al.1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires.

California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al, 1994). There are numerous occurrences within 1 mile of the proposed temporary transmission line which extends north-south between Bouldin Island and Clifton Court Forebay. However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would greatly reduce the risk of California black rails colliding with project powerlines. There would be no take of California black rail from the project as defined under Section 86 of the California Fish and Game Code.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for temporary transmission lines to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increased risk of predation on California black rail from an increase in raptor perching opportunities would be negligible.

NEPA Effects**:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce the risk of bird strike for California black rails from the project. The increased risk of predation on California black rail from an increase in raptor perching opportunities would be negligible because of the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

CEQA Conclusion**:** The construction and presence of new transmission lines would not result in "take" of California black rail pursuant to California Fish and Game Code Section 86 because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce the risk of bird strike for California black rails from the project. The increased risk of predation on California black rail from an increase in raptor perching opportunities would be negligible when considering the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Alternative 4A on California Black Rail

Indirect Construction-Related Effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions*). However, there is no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and take of any eggs and/or nestlings. The implementation of *AMM38 California Black Rail* would avoid disturbance and take of individuals by requiring preconstruction surveys of potential breeding habitat, establishment of a 500-foot no-disturbance buffer, and the presence of an onsite monitor during the breeding season (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations ranging between Operational Scenarios H3 and H4 would have an effect on salinity gradients in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on black rail. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in operations of water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have existing elevated mercury tissue levels, these low level increases could result in some level of effects. Environmental Commitment 12 would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on California black rail from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the California black rail population would be expected to be minimal as the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects**:** Noise and visual disturbances related to construction-related activities from Environmental Commitments could reduce California black rail use of modeled habitat adjacent to work sites. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by California black rail. Potential effects of noise and visual disturbances on California black rail individuals would be avoided with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on habitat for the species.

Implementation of operations ranging between Operational Scenarios H3 and H4, including operation of salinity-control gates are expected to increase water salinity in Suisun Marsh because they will create conditions more similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations would not be expected to result in increased mercury bioavailability to California black rail. Restoration actions that would create high and low tidal marsh, which is California black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

With the above measures in place, the indirect effects of Alternative 4A implementation would not result in take of California black rail individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would not have adverse effect on California black rail.

***CEQA Conclusion*:** Noise and visual disturbances related to construction-related activities and Environmental Commitments could reduce California black rail use of modeled habitat adjacent to work sites. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by California black rail. Potential effects of noise and visual disturbance on California black rail individuals would be avoided with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects on dust on habitat for the species.

Implementation of Operational Scenarios H3 and H4, including operation of salinity-control gates, are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail because they will create conditions more similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations would not be expected to result in increased mercury bioavailability to California black rail. Restoration actions that would create high and low tidal marsh, which is California black rail habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

With these measures in place, indirect effects of Alternative 4A implementation would not result in take of California black rail individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on California black rail.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Project Implementation

Restoration activities may temporarily fragment existing wetlands and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and potentially temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal freshwater emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *Environmental Commitment 4 Tidal Natural Community Restoration* activities to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *Environmental Commitment 4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *Environmental Commitment 4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects of inundation on California black rail.

NEPA Effects: There would be no periodic effects of inundation on California black rail.

CEQA Conclusion: There would be no periodic impacts of inundation on California black rail.

California Clapper Rail [1]

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on California clapper rail. California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rail secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland

[1] Based on recent genetic studies by Maley and Brumfield (2013) and Chesser et al. (2014), the "California" (*Rallus longirostris obsoletus*), "Yuma" (*R. l. yumanensis*), and "light-footed" (*R. l. levipes*) subspecies of clapper rail are now recognized by the American Ornithologists' Union (AOU) as a separate species: Ridgway's rail (*Rallus obsoletus*). Consequently, the taxon formerly known as California clapper rail (*R. l. obsoletus*) is now California Ridgway's rail (*R. o. obsoletus*). For the purposes of this document, the "California clapper rail" common name has been retained due to its use in previous BDCP documents.

transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and foraging opportunities.

Alternative 4A would occur outside of the current range of the species and would not result in effects on modeled California clapper rail habitat as indicated in Table 12-4A-25. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-25. Changes in California Clapper Rail Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	0	0
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	0	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

No habitat would be lost or converted and there would be no direct take of California clapper rail under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: There would be no effects on California clapper rail habitat.

CEQA Conclusion: There would be no impacts on California clapper rail habitat.

Impact BIO-63: Indirect Effects of the Project on California Clapper Rail

No indirect effects on California clapper rail were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: There would be no indirect effects on California clapper rail.

CEQA Conclusion: There would be no indirect impacts on California clapper rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the study area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to

3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Appendix 5.J, Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Project Implementation

No effects of fragmentation of California clapper rail were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: There would be no effects of fragmentation on California clapper rail habitat.

CEQA Conclusion: There would be no impacts of fragmentation on California clapper rail habitat.

California Least Tern

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed. Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). The study area is outside of the primary range of California least tern, although there are two CNDDB occurrences, one in Suisun Marsh (CZ 11), and one in Pittsburg (CZ 10).

Alternative 4A would result in both temporary and permanent losses of California least tern modeled foraging habitat as indicated in Table 12-4A-26.

California least tern is a fully protected species and "take" of individuals, pursuant to California Fish and Game Code Section 86, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane* and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized,* construction activities would not result in take of the species, which would avoid take under Section 86 of the California Fish and Game Code[2]. As explained below, with the expansion of aquatic foraging habitat in Clifton Court Forebay, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and mitigation to avoid impacts on terns should they nest in the study area, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-26. Changes in California Least Tern Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Foraging	281	2,019
Total Impacts Water Conveyance Facilities		**281**	**2,019**
Environmental Commitments 4, 6–7, 9–11[a]	Foraging	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**281**	**2,019**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 4A would result in the combined permanent and temporary loss of up to 2,300 acres of modeled foraging habitat for California least tern (Table 12-4A-26). The project components that would result in these losses are construction of water conveyance facilities and operation. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,300 acres of modeled California least tern aquatic foraging habitat (Table 12-4A-26). Of these acres, 281 acres would be a permanent loss the majority of which would occur where new facilities are constructed at Clifton Court Forebay. A smaller portion of the permanent loss would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay where Clifton Court Forebay levees are modified. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest affect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at three locations along the tunnel route. The water conveyance facilities footprint does not overlap with any California least tern occurrences. Refer to the

[2] Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The project proponents do not propose to hunt, pursue, catch, or capture California least tern. Killing would be avoided through AMM20.

Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and effects on nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.

- *Water Facilities Operations and Maintenance*: Post construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic postconstruction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the project. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in the west Delta area (CZ 10). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or take of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or take would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraph summarizes the combined effects discussed above and describes Environmental Commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

With Alternative 4A implementation, there would be a permanent loss of 281 acres of modeled foraging habitat for California least tern in the study area. The permanent loss would occur primarily from the expansion of the Clifton Court Forebay and, a lesser amount would be lost along the Sacramento River. In addition, 2,019 acres would be temporarily unavailable from the dredging of the Clifton Court Forebay. The temporary loss of habitat would not be expected to adversely affect California least tern as the impact area is outside of their primary range.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by water conveyance facilities would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 281 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the permanent loss of potential California least tern habitat from the construction of the water conveyance facilities. Part of the project includes the permanent expansion of the Clifton Court Forebay, which would create approximately 450 acres of aquatic habitat, which would be available for the California least tern if they were to forage in the area. This habitat creation would occur within the same timeframe as the construction temporary and permanent losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat. In addition, up to 295 acres of tidal natural communities would be restored in the Delta, which would provide foraging opportunities for the species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would be available to address this adverse effect on nesting California least terns.

NEPA Effects: The potential for effects on California least tern associated with Alternative 4A would represent an adverse effect in the absence of the mitigation measure and AMMs described below. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this effect on nesting California least terns. Temporary impacts on tidal perennial aquatic habitat in Clifton Court Forebay associated with dredging would not be expected to impact California least tern, as this region of the study area is outside of their primary range. The restoration of aquatic habitat associated with the expansion of the Clifton Court Forebay (water conveyance facilities), and Environmental Commitment 4 (tidal restoration) would be sufficient to compensate for permanent impacts on California least tern foraging habitat. With these acres of restoration, in addition to the implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 4A as a whole on California least tern would not be adverse.

CEQA Conclusion: The potential effects on California least tern associated with Alternative 4A would represent an adverse effect in the absence of the Mitigation Measure and AMMs described below as a result of potential for take of a special-status species. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would avoid the potential for take of California least tern individuals and reduce this effect to a less-than-significant impact.

Temporary impacts on tidal perennial aquatic habitat in Clifton Court Forebay associated with dredging would not be expected to impact California least tern, as this region of the study area is outside of their primary range. The restoration of aquatic habitat associated with the expansion of the Clifton Court Forebay (water conveyance facilities), and *Environmental Commitment 4 Tidal Natural Communities Restoration* would be sufficient to compensate for permanent impacts on California least tern foraging habitat. With these acres of restoration, in addition to the implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 4A as a whole on California least tern would not result in a substantial adverse effect through habitat modifications and would avoid take of individuals. Therefore, the implementation of Alternative 4A would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of the Project on California Least Tern

Indirect Construction- and Operation-Related Effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Project activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows with water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and largemouth bass tissues were insignificant (see Appendix 11F, Section 11F.5.2, *Effects of Contaminants on Terrestrial Species*).

Marsh (tidal and nontidal) restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in BDCP Appendix 5.D, *Contaminants*).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-Alternative 4A, these low level increases could result in some level of effects. Environmental Commitment 12, described below, would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on California least tern.

Because of the uncertainty that exists with respect to specific siting of tidal restoration areas, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances within 500 feet of construction-related activities from the Environmental Commitments could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–7, AMM12, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of Alternative 4A implementation would not result in an adverse effect on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

CEQA Conclusion: Noise and visual disturbances within 500 feet of construction-related activities from the Environmental Commitments would not be expected to disturb California least tern foraging habitat adjacent to work sites. If terns were to nest in newly graded restoration sites during construction activities, Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid the potential for disturbance and take of California least tern individuals.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–7, AMM12, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of Alternative 4A implementation would not result in take of California least tern individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of take of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would further reduce the potential for powerline collisions. There would be no take of California least tern from the project purrsuant to California Fish and Game Code Section 86.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would not result in take of California least tern pursuant to California Fish and Game Section 86Code because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. *AMM20 Greater Sandhill Crane* contains the commitment for all new transmission lines constructed as a result of the project to be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, there would be no take of California least tern from the project under California Fish and Game Code Section 86, and the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes permanent and temporary "roosting and foraging" and "foraging" habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (see BDCP Appendix 2.A *Covered Species Accounts*). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those only used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (see BDCP Appendix 2.A).

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-4A-27. Full implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles that would benefit the greater sandhill crane.

- Protect high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres. [In order to offset the effects on foraging habitat for both greater and lesser sandhill cranes, foraging habitat will be replaced at a minimum of 1:1 based on the acreage of impact on either the greater or lesser sandhill crane foraging habitat, whichever is greater.] (Resource Restoration and Performance Principle GSC1).
- Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principle GSC2).

- Create at least two 90-acre wetland complexes within the Stone Lakes NWR project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes NWR for greater sandhill crane (Resource Restoration and Performance Principle GSC3).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principle GSC4).

Greater sandhill crane is a fully protected species and take of individuals, pursuant to Section 86 of the California Fish and Game Code, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane*, construction activities would not result in take of the species and would avoid take pursuant to Section 86 of the California Fish and Game Code. As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-27. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	4
	Roosting and Foraging–Temporary	16	71
	Foraging	1,695	772
Total Impacts Water Conveyance Facilities		**1,711**	**847**
Environmental Commitments 4, 6–7, 9–11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	1	0
	Foraging	2,017	0
Total Impacts Environmental Commitments 4, 6–9–11[a]		**2,018**	**0**
Total Roosting/Foraging–Permanent		**0**	**4**
Total Roosting/Foraging–Temporary		**17**	**71**
Total Foraging		**3,712**	**772**
TOTAL IMPACTS		**3,729**	**847**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 92 acres of modeled roosting and foraging habitat (17 acres of permanent loss, 75 acres of temporary loss) and 4,484 acres of foraging habitat for greater sandhill crane (3,712 of permanent loss, 772 acres of temporary loss; see Table 12-4A-27). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reuseable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Natural Community Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to nontidal wetland through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities as they are currently designed would result in the combined permanent loss of up to 1,711acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,695 acres of foraging habitat (Table 12-4A-27). Foraging habitat that would be permanently impacted by water conveyance construction would consist of 1,050 acres of very high-value, 29 acres of high-value, 199 acres of medium-value, and 492 acres of low-value foraging habitat (Table 12-4A-28). In addition, 4 acres of permanent roosting and foraging habitat, 71 acres of temporary roosting and foraging habitat, and 772 acres of foraging habitat would be temporarily removed (Table 12-4A-27, Table 12-4A-28). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction; however, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

  The acres of roosting and foraging habitat that would be removed would occur from the construction of a temporary transmission line on Zacharias Island, Bouldin Island, and Venice Island and from the construction of a temporary concrete batch plant and a permanent access road on Bouldin Island; however, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for greater sandhill crane bird strike on electrical transmission facilities is addressed below under Impact BIO-70.

Activities that would impact modeled greater sandhill crane foraging habitat consist of intermediate forebay and intake construction, construction and use of temporary access roads, and construction of temporary transmission lines. Loss of foraging habitat would also result from the construction of permanent and temporary access roads on Mandeville and Bacon Islands, and from construction of vent shafts on Staten and Bacon Island. Temporary impacts on foraging habitat would also result form geotechnical boring activities along the tunnel alignment. Approximately 1,502 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

Construction-related activities would not be expected to result in take of greater sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for greater sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-70.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-71. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-28. Value of Greater Sandhill Crane Foraging Habitat affected by Alternative 4A

Foraging Habitat Value Class	Land Cover Type	Amount Affected by Water Conveyance Facilities permanent [temporary] (acres)	Amount Affected by Environmental Commitments (permanent acres)
Very high	Corn, rice	1,050 [216]	534
High	Wheat, managed wetlands,	0 [21]	226
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	180 [307]	648
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	465 [229]	609
Total		**1,695 [772]**	**2,017**

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 1 acre of temporary roosting and foraging habitat and 88 acres of greater sandhill crane foraging habitat in the north Delta. Loss of foraging habitat from Environmental Commitment 4 would consist of 23 acres of very high-value, 10 acres of high-value, 28 acres of medium-value, and 27 acres of low-value foraging habitat.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss of approximately 251 acres of greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 66 acres of very high-value, 28 acres of high-value, 81 acres of medium-value, and 76 acres of low-value foraging habitat.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of cultivated lands that comprise greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 222 acres of very high-value, 94 acres of high-value, 271 acres of medium-value, and 255 acres of low-value foraging habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the greater sandhill crane. Impacts would consist of approximately 219 acres of very high-value, 93 acres of high-value, 268 acres of medium-value, and 252 acres of low-value foraging habitat (Table 12-4A-28). A portion of the restored nontidal marsh would be expected to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this

restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 3 acres of foraging habitat and temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to result in take of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*.
- *Water Facilities Operations and Maintenance:* Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A Environmental Commitments that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 92 acres roosting and foraging habitat (17 acres of permanent loss, 75 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,484 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,467 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration,* and *Environmental Commitment 10 Nontidal Marsh Restoration*—2,017 acres). Of these acres of foraging habitat impact, 3,182 acres would be medium- to very high-value habitat (Table 12-4A-28).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of foraging habitat. Using these ratios would indicate that 92 acres of greater sandhill crane roosting habitat should be restored/created and 92 acres should be protected to compensate for the losses of greater sandhill crane roosting and foraging habitat. In addition, 4,484 acres of high- to very high-value foraging habitat should be protected to mitigate the losses of greater sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* would require no direct impact of greater sandhill crane roost sites by project activities related to water conveyance facilities, including transmission lines and their associated footprints (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 91 acres of roosting and foraging habitat. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

Under Alternative 4A, project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

As directed by Resource Restoration and Protection Principle GSC1, at least 4,584 acres of cultivated lands that provide high- to very high-value foraging habitat would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types in any given year (see Table 12-4-28 for greater sandhill crane foraging habitat values).

The project also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on greater sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting greater sandhill crane habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of greater sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that are greater than the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1-GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and AMM30 *Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Construction activities would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: The effects on greater sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of other Environmental Commitments, Resource Restoration and Performance Principles GSC1-GSC4, and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines*, which would be in place during all project activities. Construction activities would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications. Therefore, Alternative 4A would have a less-than-significant impact on greater sandhill cranes under CEQA.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the sandhill crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential for birdstrikes could be exacerbated by construction-related effects, especially in low-visibility conditions. The potential take of greater sandhill crane in the area of the proposed transmission lines was estimated for the BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that risk of take could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Alternative 4A would substantially reduce the length of permanent and temporary transmission lines as compared with the BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by greater sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the BDCP.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. In addition, after the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meets the performance standard of no take of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would not result in take of greater sandhill crane pursuant to California Fish and Game Code Section 86. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed for the project, in an area with the same or higher greater sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing take in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity. Considering that the temporary lines would be removed within the first 10–14 years of

Alternative 4A implementation, and with the implementation of one or a combination of the measures described under *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project pursuant to California Fish and Game Code Section 86.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the sandhill crane winter use area. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the sandhill crane winter use area. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project pursuant to California Fish and Game Code Section 86, and the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of the Project on Greater Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and Environmental Commitments could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane*, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-4A-29. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 4A (acres)

	General Construction	
Habitat Type	Above 60 dBA	Above 50 dBA
Permanent Roosting	196	1,008
Temporary Roosting	810	1,909
Foraging	7,676	17,327
Total Habitat	**8,681**	**20,243**

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (see BDCP Chapter 5). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see BDCP Chapter 5).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (see Appendix 3B, *Environmental*

Commitments, AMMs, and CMs). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. The implementation of AMM1–AMM6 would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) have the potential to exacerbate bioaccumulation of mercury in greater sandhill crane. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations from the construction of the water conveyance facilities (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on greater sandhill crane because of their position in the foodweb. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for greater sandhill crane because they primarily forage on waste grains and, to a lesser extent, invertebrates associated with cultivated crops. The modeled effects of mercury concentrations from changes in water operations with water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with *Environmental Commitment 10 Nontidal Marsh Restoration* may indirectly affect greater sandhill crane via uptake in lower trophic levels (see Appendix 11F, Section 11F.5.2, *Effects of Contaminants on Terrestrial Species*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Environmental Commitment 10 (Nontidal Marsh Restoration) has the potential to mobilize selenium, and therefore increase greater sandhill crane exposure from ingestion of prey items (waste grain and associated invertebrates) with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related Environmental Commitments (Environmental Commitment 10) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to compensate for affected habitat.

The implementation of *Environmental Commitment 10 Nontidal Marsh Restoration* could result in increased exposure of greater sandhill crane to methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation on greater sandhill crane would not be adverse under NEPA.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would not result in an adverse effect on greater sandhill crane under NEPA.

***CEQA Conclusion*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate impacts on affected habitat.

The implementation of *Environmental Commitment 10 Nontidal Marsh Restoration* could result in increased exposure of greater sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on greater sandhill crane under CEQA.

Lesser Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane is limited to the sandhill crane winter use area (Figure 12-22) and includes "roosting and foraging" (known roost sites that also provide foraging habitat) and "foraging" habitat. Suitable roosting and foraging habitat in the study area includes certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and that also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (see BDCP Appendix 2.A, *Covered Species Accounts*). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane. Therefore, within the sandhill crane winter use area, there is more suitable foraging habitat modeled for lesser sandhill crane than for greater sandhill crane.

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-4A-30. Full implementation of Alternative 4A would include the following Resource Restoration and Performance Principles for greater sandhill crane that would similarly benefit the lesser sandhill crane.

- Protect high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres [In order to offset the effects on foraging habitat for both greater and lesser sandhill cranes, foraging habitat will be replaced at a minimum of 1:1 based on the acreage of impact on either the greater or lesser sandhill crane foraging habitat, whichever is greater.] (Resource Restoration and Performance Principles GSC1).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principles GSC2).

- Create at least two 90-acre wetland complexes within the Stone Lakes NWR project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes NWR for greater sandhill crane (Resource Restoration and Performance Principles GSC3).

- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principles GSC4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would be less than significant for CEQA purposes, and would not be adverse for NEPA purposes.

Table 12-4A-30. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	4
	Roosting and Foraging–Temporary	16	71
	Foraging	1,707	860
Total Impacts Water Conveyance Facilities		**1,723**	**935**
Environmental Commitments 4, 6––11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	1	0
	Foraging	2,017	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,018**	**0**
Total Roosting/Foraging–Permanent		**0**	**4**
Total Roosting/Foraging–Temporary		**17**	**71**
Total Foraging		**3,724**	**860**
TOTAL IMPACTS		**3,741**	**935**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 92 acres of modeled roosting and foraging habitat (17 acres of permanent loss, 75 acres of temporary loss) and 4,584 acres of foraging habitat (3,724 acres of permanent loss, 860 acres of temporary loss, Table 12-4A-30). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reusable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of foraging habitat to nontidal natural communities through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent loss of up to 1,723 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,707 acres of foraging habitat. Foraging habitat that would be permanently impacted by water conveyance construction would consist of 1,018 acres of very high-value, 135 acres of high-value, and 301 acres of medium-value foraging habitat (Table 12-4A-31). In addition, 4 acres of permanent roosting and foraging habitat, 71 acres of temporary roosting and foraging habitat, and 860 acres of foraging habitat would be temporarily removed (Table

12-4A-30). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

- The acres of roosting and foraging habitat that would be permanently removed is located on Bouldin Island, from the construction of a permanent access road. Temporary impacts on roosting and foraging habitat would occur on Bouldin Island from the construction of a temporary concrete batch plant and a fuel station. Temporary losses would also occur from the construction of temporary transmission lines between the Lambert Road vent shaft and the intermediate forebay, and on Venice Island. However, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

- Activities that would impact modeled lesser sandhill crane foraging habitat consist of intermediate forebay and intake construction, construction and use of temporary access roads, and construction of temporary transmission lines. Loss of foraging habitat would also result from the construction of permanent and temporary access roads on Mandeville and Bacon Islands, and from construction of vent shafts on Staten and Bacon Islands. Temporary impacts on foraging habitat would also result form geotechnical boring activities along the tunnel alignment. Approximately 1,502 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would be stored on Bouldin Island, Zacharias Island and parcels south of Lambert Road and north of the Cosumnes River. The reusable tunnel material would likely be moved to other sites for use in levee build-up and restoration, and the affected areas would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils* would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

  Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for lesser sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-73.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-74. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-31. Value of Lesser Sandhill Crane Foraging Habitat Affected By Alternative 4A Water Conveyance Facilities

Foraging Habitat Value Class	Land Cover Type	Water Conveyance Facilities Permanent [Temporary] (acres)
Very high	Corn, alfalfa and alfalfa mixtures	1,018[319]
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	135 [124]
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, unirrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	301 [201]
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	242 [205]
None	Vineyards, orchards	12 [10]

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 1 acre of temporary roosting and foraging habitat and 88 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 251 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be restored to provide roosting and foraging habitat value for sandhill cranes. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *Environmental Commitment 11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 3 acres of foraging habitat and temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to

result in direct mortality of lesser sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*.

- *Water Facilities Operations and Maintenance*: Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 92 acres roosting and foraging habitat (17 acres of permanent loss, 75 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,584 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,567 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration* and *Environmental Commitment 10 Nontidal Marsh Restoration*—2,017 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 92 acres of sandhill crane roosting habitat should be restored/created and 92 acres should be protected to compensate for the losses of lesser sandhill crane roosting and foraging habitat. In addition, 4,584 acres of foraging habitat should be protected to mitigate the losses of lesser sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* would require no direct impacts on sandhill crane roost sites by project activities related to water conveyance facilities, including transmission lines and their associated footprints (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 91 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

Alternative 4A also includes the following performance standards for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites (Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that would protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of sandhill crane wintering habitat.

As specified in GSC1, at least 4,584 acres of cultivated lands that provide high- to very high-valueforaging habitat for greater sandhill crane would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types for greater sandhill crane in any given year (which would be high- to very high-value crop types for the lesser sandhill crane; see Table 12-4A-28 and Table 12-4A-31 for sandhill crane foraging habitat values). The remaining habitat protected could range between medium to very-high value habitat for lesser sandhill crane. The proposed project would also include commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on lesser sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting lesser sandhill crane habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of lesser sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that meet the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1-GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: The effects on lesser sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of Environmental Commitments, Resource Restoration and Performance Principles GSC1-GSC4 for greater sandhill crane (which would also benefit lesser sandhill crane), and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and*

Alignment Guidelines, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, Alternative 4A would have a less-than-significant impact on lesser sandhill cranes under CEQA.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the sandhill crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes NWR. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential for birdstrikes could be exacerbated by construction-related effects, especially in low-visibility conditions. The potential mortality of greater sandhill crane in the area of the proposed transmission lines was estimated for the BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

The transmission line footprint for Alternative 4A was changed substantially from the BDCP to reduce potential risk of greater sandhill crane collisions. The following changes also reduce potential risk of lesser sandhill crane collisions:

Alternative 4A would substantially reduced the length of permanent and temporary transmission lines as compared with the BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by both greater and lesser sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the BDCP.

AMM30 Transmission Line Design and Alignment Guidelines would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. In addition, after the Draft EIR/EIS was issued in December 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meet the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: 1) siting new transmission lines in lower bird strike risk zones; 2) removing, relocating or undergrounding existing lines where feasible; 3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the sandhill crane winter use area; 4) undergrounding new lines in high-risk zones of the sandhill crane winter use area; 5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the sandhill crane winter use area; 6) for areas outside of the Stone Lakes NWR project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would substantially reduce potential collisions of lesser sandhill cranes with transmission lines. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60% The length of existing line to be fitted with bird strike diverters would be equal to the length of new transmission lines constructed as a result of the project, in an area with the same or higher lesser sandhill crane strike risk to provide a net benefit to the species. For optimum results, the recommended spacing distance for bird flight diverters is 15 to 16.5 feet (4.5 to 5 meters) (Avian Power Line Interaction Committee 1994). Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and, therefore, would result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on lesser sandhill crane.

***CEQA Conclusion*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. *AMM30 Transmission Line Design and Alignment Guidelines* would require design features for the transmission line alignment, such as co-locating transmission lines when it would minimize effects on sandhill cranes, to avoid impacts on sensitive habitats to the maximum extent feasible. All new transmission lines constructed for the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating *AMM30 Transmission Line Design and Alignment Guidelines* and one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of the Project on Lesser Sandhill Crane

Indirect Construction- and Operation-Related Effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and Environmental Commitments could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane*, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see BDCP Chapter 5, *Effects Analysis*). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts, and be more vulnerable to predators. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (see BDCP Chapter 5). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see BDCP Chapter 5).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. The implementation of AMM1–AMM6 would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of *Environmental Commitment 10 Nontidal Marsh Restoration* have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations from the construction of the water conveyance facilities (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on lesser sandhill crane because of their position in the foodweb. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for lesser sandhill cranes because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. The modeled effects of mercury concentrations from changes in water conveyance facilities operations on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with *Environmental Commitment 10 Nontidal Marsh Restoration* may indirectly affect lesser sandhill crane via uptake in lower trophic levels (see Appendix 11F, Section 11F.5.2, *Effects of Contaminants on Terrestrial Species*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. *Environmental Commitment 10 Nontidal Marsh Restoration* has the potential to mobilize selenium, and therefore increase lesser sandhill crane exposure from ingestion of prey items with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related Environmental Commitments (Environmental Commitment 10) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats (see 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

NEPA Effects: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to compensate for effects on habitat.

The implementation of *Environmental Commitment 10 Nontidal Marsh Restoration* could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of lesser sandhill crane to methylmercury and selenium. methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill crane. Therefore, the indirect effects of Alternative 4A implementation on lesser sandhill crane would not be adverse under NEPA.

***CEQA Conclusion*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate for affected habitat, there would not be an adverse effect on lesser sandhill crane.

The implementation of *Environmental Commitment 10 Nontidal Marsh Restoration* could result in increased exposure of lesser sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Alternative 4A would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-4A-32. Full implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles that would benefit least Bell's vireo and yellow warbler.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2).
- The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation and will be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principle VFR3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-32. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Migratory and breeding	30	20
Total Impacts Water Conveyance Facilities		**30**	**20**
Environmental Commitments 4, 6–7, 9–11[a]	Migratory and breeding	10	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**10**	**0**
TOTAL IMPACTS		**40**	**20**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 4A would result in the combined permanent and temporary loss of 60 acres of modeled habitat (40 acres of permanent loss and 20 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-4A-32). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas and *Environmental Commitment 4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 50 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-4A-32). Of the 50 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 30 acres would be a permanent loss and 20 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of the construction of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3, 4, 5, 6, and 8. Permanent habitat loss would result from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would resulted from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require at least four years for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the water conveyance facilities footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 10 acres of modeled least Bell's vireo and yellow warbler habitat.

- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the study area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the study area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Nesting of least Bell's vireo and yellow warbler has not been confirmed in the study area. Although there have been recent occurrences of least Bell's vireo in the Yolo Bypass and of both least Bell's vireo and yellow warbler at the San Joaquin River National Wildlife Refuge, the reestablishment of a breeding population of either species unlikely over the term of the project (14 years). If present in the study area, construction-related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 60 acres of habitat for these species during the term of the Plan (<1% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 60 acres of valley/foothill riparian habitat should be restored/created and 60 acres should be protected to compensate for the losses of least Bell's vireo and yellow warbler habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature riparian forest would be maintained within either CZ 4 (in the vicinity of Cosumnes River Preserve) or CZ 7 (in the vicinity of San Joaquin National Wildlife Refuge and Caswell State Memorial Park) (Resource Restoration and Performance Principle VFR2). The mature riparian forest would be intermixed with a portion of the early- to mid-successional riparian vegetation and would be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principle VFR3).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, and by AMM1–AMM7, and AMM22. Mitigation Measure BIO-75 would be available to address potential adverse effects on nesting yellow warblers. Environmental commitments and AMMs would be in place during all project activities. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. Considering these commitments, losses and conversions of least Bell's vireo and yellow warbler habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of least Bell's vireo and yellow warbler habitat from Alternative 4A would represent an adverse effect in the absence of other conservation actions as a result of habitat modification and potential for direct mortality of a special-status species. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. In addition, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principles VFR1-VFR3 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, in addition to Mitigation Measure BIO-75, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of least Bell's vireo or yellow warbler. Therefore, Alternative 4A would have a less-than-significant impact on least Bell's vireo and yellow warbler under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below prior to construction and operations and maintenance activities.

- To the maximum extent feasible, vegetation removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.
- A qualified wildlife biologist with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat in the construction area. In addition, a 500-foot radius around the construction area, where accessible, will be surveyed for nesting raptors and species of special concern (except the Modesto song sparrow), and an area within 50 feet of construction will be surveyed for other non-special status nesting birds or birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.
- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by DWR biologists in consultation with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest

and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11, which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

NEPA Effects**:** Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11. Therefore, the effect of habitat fragmentation would not have an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion**:** Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11. Therefore, the effect of habitat fragmentation, as a result of Alternative 4A would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). The behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines unlikely. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that the transmission lines are designed to avoid sensitive terrestrial habitats (including riparian) when siting poles and towers to the maximum extent feasible, which would minimize the potential for collision. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

NEPA Effects: Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which will minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

CEQA Conclusion: Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the lack of occurrences in the study area and the behavior and habitat requirements of these species. *AMM30 Transmission Line Design and Alignment Guidelines* would avoid impacts on riparian habitat to the maximum extent feasible, which will minimize the potential for collision. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of The Project on Least Bell's Vireo and Yellow Warbler

Indirect Construction- and Operation-Related Effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower trophic levels (as described in Appendix 11F, *Substantive BDCP Revisions*).

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which

forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least Bell's vireo and yellow warbler. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on least Bell's vireo and yellow warbler from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the species populations would be expected to be minimal because the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting yellow warblers.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the species populations. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of least Bell's vireo and yellow warbler to methylmercury. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion**:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have an adverse effect on least Bell's vireo and yellow warbler in the absence of Environmental Commitments and AMMs as a result of habitat modification and potential for direct mortality of special-status species. With the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring* in place, the effect would not be adverse.

Tidal habitat restoration could result in increased exposure of least Bell's vireo and yellow warbler to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the species populations. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of least Bell's vireo and yellow warbler to methylmercury. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM22, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of least Bell's vireo or yellow warbler. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on least Bell's vireo or yellow warbler.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on least Bell's vireo or yellow warbler.

NEPA Effects: No effect.

CEQA Conclusion**:** No impact.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects on Suisun song sparrow and saltmarsh common yellowthroat is based on primary breeding habitat and secondary habitat. Suisun song sparrow and saltmarsh common yellowthroat primary habitat consists of all *Salicornia*-

dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the study area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and high-value forage.

Alternative 4A would result in no effects on modeled Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-4A-33. There is no modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-33. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	0	0
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	0	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

No habitat would be lost or converted and there would be no direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species are known to occur.

***NEPA Effects*: No effect.**

***CEQA Conclusion*: No impact.**

Impact BIO-81: Indirect Effects of Alternative 4A on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

No indirect effects on Suisun song sparrow and saltmarsh common yellowthroat were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where these species are known to occur.

NEPA Effects: No effect.

CEQA Conclusion: No Impact.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the study area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the study area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the study area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 4A would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Alternative 4A would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-4A-34. The majority of the losses would occur from the construction of the water conveyance facilities. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the first 10 years. Full implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit the Swainson's hawk.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).

- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principles VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ7. The mature riparian forest intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principles VFR1 and VFR2).
- Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres (Resource Restoration and Performance Principle SH1).
- Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) production (Resource Restoration and Performance Principle SH2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM18 Swainson's Hawk* to minimize potential effects, impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-34. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	16	10
	Foraging	3,238	1,052
Total Impacts Water Conveyance Facilities		**3,254**	**1,062**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
	Foraging	2,427	0
Total Impacts Environmental Commitments 4, 6–9–11[a]		**2,432**	**0**
Total Nesting		**21**	**10**
Total Foraging		**5,665**	**1,052**
TOTAL IMPACTS		**5,686**	**1,062**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 4A would result in the combined permanent and temporary loss of up to 6,748 acres of modeled habitat (31 acres of nesting habitat and 6,717 acres of foraging habitat) for Swainson's hawk (Table 12-4A-34). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 26 acres of Swainson's hawk nesting habitat (16 acres of permanent loss habitat and 10 acres of temporary loss). In addition, 4,290 acres of foraging habitat would be removed (3,238 acres of permanent loss, 1,052 acres of temporary loss; Table 12-4A-34). Activities that would impact modeled Swainson's hawk habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are at least 12 occurrences of nesting Swainson's hawk that overlap with the construction footprint of water conveyance facilities, primarily from the construction of intakes 2, 3, and 5, and the construction footprint for the permanent and temporary transmission lines. The implementation of *AMM18 Swainson's Hawk*, would minimize the effects of construction on nesting Swainson's hawks if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS). Impacts on foraging habitat would occur throughout the central Delta in CZs 3–6, and CZ 8. Permanent foraging habitat impacts would include 849 acres of very high-value habitat (Table 12-4A-35). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-35. Acres of Impacted Foraging Habitat by Value Classes for Swainson's Hawk

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	Water Conveyance Facilities Permanent (temporary)	Environmental Commitments Permanent (temporary)
Very high	Alfalfa hay	849 (128)	681 (0)
Moderate	Irrigated pasture, other hay crops	745 (350)	752 (0)
Low	Other irrigated field and truck/berry crops	668 (234)	551 (0)
Very low	Safflower, sunflower, corn, grain sorghum	977 (340)	443 (0)

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of Swainson's hawk nesting habitat and 254 acres of foraging habitat. Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of Swainson's hawk foraging habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands that provide Swainson's hawk foraging habitat to grassland.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of Swainson's hawk foraging habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.
- Permanent and temporary nesting habitat losses from the above Environmental Commitments would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly (within 10–14 years of Alternative 4A implementation).
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into Alternative 4A.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments and Resource Restoration and Performance Principles that offset or avoid these effects. NEPA and CEQA conclusions are also provided at the end of the section.

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 31 acres of potential nesting habitat (<1% of the potential nesting habitat in the study area) and 6,748 acres of foraging habitat (1% of the foraging habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 31 acres of nesting habitat should be restored/created and 31 acres should be protected to compensate for the losses of Swainson's hawk nesting habitat. In addition, 6,748 acres of foraging habitat should be protected to mitigate the losses of Swainson's hawk foraging habitat.

Project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (Resource Restoration and Performance Principle SH1). These acres of cultivated lands and grasslands would be located above 1 foot above sea level, and at least 50% would be in very high-value production (Resource Restoration and Performance Principle SH2). These Resource Restoration and Performance Principles would be associated with Environmental Commitment 3 and would occur in the same timeframe as the construction and early restoration losses.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland, which would provide nesting habitat for Swainson's hawk. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. A single, contiguous patch of 100 acres of mature riparian forest would be maintained in either CZ 4 or CZ 7, ensuring that acres of restored and protected habitat provide habitat for nesting raptors. In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Environmental Commitment 3).

The 251 acres of restored riparian habitat would be initiated in the first 10 years to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the first 10 years. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (5-gallon container size) would be planted for every tree removed by construction that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk. Swainson's hawk foraging habitat would be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land. Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Swainson's hawk nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1, VFR2, SH1, SH2, and CL1, and by AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. Considering these commitments, losses and conversions of Swainson's hawk habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on Swainson's hawk habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11 that meet or exceed the typical mitigation ratios described above. These conservation activities would be guided by Resource Restoration and Performance Principles VFR1, VFR2, SH1, SH2, and CL1s, and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Swainson's hawk. Therefore, Alternative 4A would have a less-than-significant impact on Swainson's hawk under CEQA.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. However, this species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the study area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

NEPA Effects: New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

CEQA Conclusion: New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. With implementation of *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of The Project on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and Environmental Commitments could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4). However, there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with Alternative 4A actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, and *AMM18 Swainson's Hawk.*

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on Swainson's hawk.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Tricolored Blackbird

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on tricolored blackbird. The habitat model used to assess effects for tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass, along the southwestern perimeter of the study area, and in the southeast corner of the study area near the San Joaquin River, breeding colonies are uncommon in the study area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the study area. The nesting component consists of nontidal freshwater perennial emergent marsh, and valley foothill riparian natural communities that occur within 5 miles of breeding colonies documented between 1998 and 2012. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the study area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Alternative 4A would result in both temporary and permanent losses of tricolored blackbird modeled breeding and nonbreeding habitat as indicated in Table 12-4A-36. Full implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles to benefit the tricolored blackbird.

- Protect and manage occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence, or other non-marsh nesting habitat suitable for the species. If sufficient acres of protection are not available, create suitable nesting habitat at a ratio of 1:1 (Resource Restoration and Performance Principle TB1).
- Protect high- to very high-value breeding-foraging habitat (as defined in Table 12-4A-37) (within 5 miles of occupied or recently occupied) (within the last 15 years) tricolored blackbird nesting habitat. At least 130 acres will be within 3 miles of the 38 acres of nontidal wetland nesting habitat protected (Resource Restoration and Performance Principle TB2).
- Protect moderate-, high-, or very high-value cultivated lands (as defined in Table 12-4A-37) as nonbreeding foraging habitat, at least 50% of which is of high- or very high-value (Resource Restoration and Performance Principle TB3).
- Protect up to 119 acres and restore up to 832 acres of nontidal wetland (Environmental Commitment 3 and Environmental Commitment 10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-36. Changes to Tricolored Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type		Permanent	Temporary
Water Conveyance Facilities	Breeding	Nesting	15	4
		Foraging-cultivated	1,389	172
		Foraging-noncultivated	290	105
	Non-breeding	Roosting	9	21
		Foraging-cultivated	1,047	487
		Foraging-noncultivated	179	53
Total Impacts Water Conveyance Facilities			**2,929**	**842**
Environmental Commitments 4, 6–7, 9–12, and 15–16[a]	Breeding	Nesting	0	0
		Foraging-cultivated	806	0
		Foraging-noncultivated	58	0
	Non-breeding	Roosting	17	0
		Foraging-cultivated	1,502	0
		Foraging-noncultivated	23	0
Total Impacts Environmental Commitments 4, 6–7, 9–12, and 15–16[a]			**2,405**	**0**
Total Breeding			**2,558**	
Total Nonbreeding			**2,777**	
TOTAL IMPACTS			**5,335**	**842**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 4A would result in the combined permanent and temporary loss of up to 6,177 acres of modeled habitat (2,839 acres of breeding habitat and up to 3,338 acres of nonbreeding habitat) for tricolored blackbird (Table 12-4A-36). Project components that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the permanent loss of 1,694 acres of tricolored blackbird breeding habitat (15 acres nesting habitat, 1,389 acres of cultivated lands, and 290 acres of noncultivated lands suitable for foraging) and 1,235 acres of nonbreeding habitat (9 acres roosting habitat, 1,047 acres of cultivated lands, and 179 acres of noncultivated lands suitable for foraging, Table 12-4A-36).

Approximately 796 of the 1,757 acres permanently impacted would be lost as reusable tunnel material storage areas, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. In addition, water conveyance facilities would result in the temporary removal of 281 acres of breeding habitat (4 acres nesting habitat, 172 acres of cultivated lands, and 105 acres of noncultivated lands suitable for foraging) and 561 acres of nonbreeding habitat (21 acres roosting habitat, 487 acres of cultivated lands, and 53 acres of noncultivated lands suitable for foraging, Table 12-4A-36). *AMM21 Tricolored Blackbird* would minimize the effects of construction on nesting tricolored blackbirds if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within 10–14 years.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 116 acres of breeding habitat and 116 acres of nonbreeding habitat. No nesting habitat would be removed as a result of tidal natural communities restoration.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: Riparian natural communities restoration could remove approximately 5 acres of breeding habitat and 246 acres of nonbreeding habitat.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: Grassland natural communities restoration would convert approximately 407 acres of breeding foraging habitat and 663 acres of nonbreeding foraging habitat consisting of cultivated lands and grasslands. Grassland provides high-value foraging habitat for tricolored blackbird during the breeding season. Therefore, while impacted habitat may be temporarily unavailable, restored grasslands would be expected to provide foraging habitat for the species if in the vicinity of breeding colonies.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 316 acres of breeding foraging habitat and 516 acres of nonbreeding foraging habitat (all cultivated lands suitable for foraging). Some portion of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide roosting habitat for tricolored blackbird depending on vegetation density and composition.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in protected habitats could result in localized ground disturbances that could permanently remove 20 acres of tricolored blackbird breeding habitat and temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. Construction activities would avoid active tricolored blackbird nesting colonies and associated habitat during the breeding season (generally March 15–July 31). Avoidance measures would include relocating project activities away from the nesting colonies and associated habitat to the maximum extent practicable. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 250 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. These measures to avoid injury or mortality of nesting and roosting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Table 12-4A-37. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands, unsprayed alfalfa, unsprayed sunflower, unsprayed mixed alfalfa	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies,	Corn, sunflower, alfalfa and mixed alfalfa, mixed pasture, native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands
Moderate	Miscellaneous grasses, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots, organic rice	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Mixed grain and hay crops, farmsteads, non-irrigated mixed grain and hay, rice	Wheat, oats, mixed grain and hay, farmsteads, unirrigated mixed grain and hay, and non-irrigated misc. grain and hay

[a] Generally March through August; occasional breeding in fall (September through November).

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area. Alternative 4A would result in the combined permanent and temporary loss of up to 6,177 acres of modeled habitat (2,839 acres of breeding habitat and up to 3,338 acres of nonbreeding habitat) for tricolored blackbird (2% of the total breeding habitat in the study area and 1% of the total nonbreeding habitat in the study area). These impacts would consist of 19 acres of nesting habitat, 47 acres of roosting habitat, 708 acres of noncultivated foraging habitat, and 5,403 acres of cultivated lands suitable for foraging.

Typical NEPA and CEQA project-level mitigation ratios would be 2:1 for protection of nesting habitat, 1:1 creation and 1:1 protection of roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Project proponents would commit to protecting and managing 38 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat would be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence, or other non-marsh nesting habitat suitable for the species (Resource Restoration and Performance Principle TB1). These acres would compensate for impacts on 19 acres of tricolored blackbird nesting habitat. An additional 47 acres of nontidal wetland would be protected and 47 acres would be restored which would provide sufficient compensation for impacts on 47 acres of roosting habitat. Alternative 4A would also commit to protecting 1,416 acres of high- to very high-value breeding-foraging habitat (as defined in Table 4A-38) within 5 miles of occupied or recently occupied - within the last 15 years - tricolored blackbird nesting habitat. At least 130 acres would be within 5 miles of the 38 acres of nontidal wetland nesting habitat protected (Resource Restoration and Performance Principle TB2). In addition, 5,403 acres of moderate-, high-, or very high-value cultivated lands (as defined in Table 4A-38) would be protected as nonbreeding foraging habitat, at least 50% of which would be of high- or very high-value (Resource Restoration and Performance Principle TB3). These acres would be sufficient to compensate for impacts on tricolored blackbird foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of tricolored blackbird breeding and nonbreeding habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting acreages that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles TB1-TB4, and by AMM1–AMM7, and *AMM21 Tricolored Blackbird*, which would be in place during all project activities. Considering these commitments, losses and conversions of tricolored blackbird habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on tricolored blackbird habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles TB1-TB4, and by AMM1–AMM6, and *AMM21 Tricolored Blackbird*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of tricolored blackbird. Therefore, Alternative 4A would have a less-than-significant impact on tricolored blackbird under CEQA.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area. Although migratory movements and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily in winter during daily flights between roosting and foraging sites and during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on tricolored blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily in winter during daily flights between roosting and foraging sites and during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increased risk of predation on tricolored blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 4A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of the Project on Tricolored Blackbird

Indirect Construction- and Operation-Related Effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, project activities would be avoided within a minimum 250 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony. If a colony appears to be affected, the activity would be modified, as practicable, by either delaying construction until the colony abandons the site or until the end of the breeding season, whichever occurs first, temporarily relocating staging areas, or temporarily rerouting access to the construction site. Construction and restoration projects would also be designed, in consultation with CDFW, to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Tidal and nontidal marsh restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury.

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community restoration could indirectly affect tricolored blackbird, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). A detailed review of the methylmercury issues associated with implementation of Alternative 4A is contained in Appendix 11F, *Substantive BDCP Revisions*,. The review includes an overview of the project-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Tidal and nontidal marsh restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1–AMM7, AMM21, AMM27, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on tricolored blackbird.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Burrowing Owl

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Alternative 4A would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-4A-38. Full implementation of Alternative 4A would also include the following Environmental Commitment and Resource Restoration and Performance Principle that would benefit the western burrowing owl.

- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres and would also benefit western burrowing owl:
  - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in a minimum of 40-acre patches (Resource Restoration and Performance Principle SH1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and *AMM23 Western Burrowing Ow*l, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-38. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	High-value	863	314
	Low-value	2,294	559
Total Impacts Water Conveyance Facilities		**3,157**	**873**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	521	0
	Low-value	1,902	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,423**	**0**
Total High-value		**1,384**	**314**
Total Low-value		**4,196**	**559**
TOTAL IMPACTS		**5,580**	**873**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 4A would result in the combined permanent and temporary loss of up to 6,453 acres of modeled habitat for western burrowing owl (of which 1,698 acres is of high-value and 4,755 acres is of low value, Table 12-4A-38). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 8 Grassland Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management.* Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 1,177 acres of acres of modeled high-value western burrowing owl habitat (863 acres of permanent loss, 314 acres of temporary loss) from CZs 3–6 and CZ 8. In addition, 2,853 acres of low-value burrowing owl habitat would be removed (2,294 acres of permanent loss, 559 acres of temporary loss). The majority of high-value grassland habitat that would be removed would be in CZ 8, from the construction of the new forebay in CZ 8. There is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from facility construction and the establishment of the forebay reusable tunnel material storage area could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat.
- The reusable tunnel material storage area overlaps with six occurrences of western burrowing owl and there are also several occurrences west of the new forebay control structure that could be indirectly affected by construction activities. The amount of storage area needed for reusable tunnel material is flexible (dependent on storage pile height and other factors) and the footprint used in the effects analysis is based on a worst case scenario. However, the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage. The implementation of *AMM6 Disposal and Reuse of Spoils* and *AMM23 Western Burrowing Owl* would require that to the extent practicable, the reusable tunnel material storage area footprint avoided locations where active burrows are present. The footprints of a permanent transmission line and a permanent access road, both located west of the Clifton Court Forebay overlap with an additional 8 occurrences of western burrowing owl. Preconstruction surveys would be conducted prior to any construction activities under *AMM23 Western Burrowing Owl* during the nonbreeding and the breeding season. If avoidance was not possible, passive relocation would be considered in consultation with CDFW. If owls were to be excluded from existing burrows, artificial burrows would be used if it were possible for them to be installed within 100 meters from the existing burrows on protected lands. A substantial portion of the high-value grassland protection and enhancement under *Environmental Commitment 8 Grassland Natural Community Restoration* would be expected to occur to the west and to the south of these occurrences in CZ 8, which would provide high-value protected lands in close proximity to the disturbed habitat.
- Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 153 acres of high-value and 97 acres of low-value western burrowing owl habitat.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 1 acre of high-value and 250 acres of low-value western burrowing owl habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would permanently remove approximately 235 acres of high-value and 835 acres of low-value western burrowing owl habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 112 acres of high-value and 720 acres of low-value western burrowing owl habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 20 acres of high-value western burrowing owl habitat and could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values.
- Habitat management- and enhancement-related activities and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 1,698 acres of high-value habitat (1% of the habitat in the study area) and 4,755 acres of low-value western burrowing owl habitat (2% of the habitat in the study area). These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. Using these typical ratios would indicate that 3,396 acres should be protected to compensate for the loss of high-value habitat and 4,715 acres should be protected to compensate for the loss of low-value habitat.

Project proponents would commit to protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands, which would be sufficient to compensate for impacts on western burrowing owl habitat. As part of these acres of protection, Alternative 4A would conserve 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (which would also benefit western burrowing owl), which would total 6,805 acres. These acres would be sufficient to compensate for impacts on western burrowing owl habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western burrowing owl habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle SH1, and by AMM1–AMM7, and *AMM23 Western Burrowing Owl*, which would be in place during all project activities. Considering these commitments, losses and conversions of western burrowing owl habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on western burrowing owl habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle SH1, and by AMM1–AMM6 and *AMM23 Western Burrowing Owl*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of western burrowing owl. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on western burrowing owl under CEQA.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given its physical and behavioral characteristics (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*) and new transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of the Project on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of up to 13,922 acres of modeled burrowing owl habitat (6,113 acres of high-value habitat) within 500 feet of project activities will temporarily be made less suitable as a result of construction noise and visual disturbances adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with incorporation of *AMM23 Western Burrowing Owl* into Alternative 4A, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

***NEPA Effects*:** Indirect effects on western burrowing owl as a result of Alternative 4A implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, the indirect effects from Alternative 4A implementation would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects on western burrowing owl as a result of Alternative 4A implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 4A implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on western burrowing owl.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on western yellow-billed cuckoo. The habitat model for western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres, and migratory habitat, which includes the same plant alliances as breeding habitat without the minimum 50 acres patch size requirement.

The western yellow-billed cuckoo is uncommon in the study area at present, and the likelihood that it would be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the study area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Alternative 4A would result in both temporary and permanent losses of Western yellow-billed cuckoo modeled habitat as indicated in Table 12-4A-39. Full implementation Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles which would benefit the western yellow-billed cuckoo.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7. The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation and will be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principles VFR2 and VFR3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on Western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-39. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Breeding	6	2
	Migratory	15	15
Total Impacts Water Conveyance Facilities		**21**	**17**
Environmental Commitments 4, 6–7, 9–11[a]	Breeding	2	0
	Migratory	7	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**9**	**0**
Total Breeding		**8**	**2**
Total Migratory		**22**	**15**
TOTAL IMPACTS		**30**	**17**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 4A would result in the combined permanent and temporary loss of up to 47 acres of modeled habitat for western yellow-billed cuckoo (10 acres of breeding habitat, 37 acres of migratory habitat, Table 12-4A-39). Project components that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 8 acres of breeding habitat (6 acres of permanent loss, 2 acres of temporary loss) for yellow-billed cuckoo. In addition, 30 acres of migratory habitat would be removed (15 acres of permanent loss, 15 acres of temporary loss, see Table 12-4A-39). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and 8. Permanent habitat loss would occur from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. Permanent and temporary habitat losses from the Environmental Commitments would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

  There are no extant occurrences of yellow-billed cuckoo nests in the study area; however, habitat loss from the construction of water conveyance facilities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the effects of construction on nesting cuckoos if present in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 2 acres of modeled yellow-billed cuckoo breeding habitat and 7 acres of modeled migratory habitat. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) in CZ 5 between Twin Cities Road and Walnut Grove.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat. With conditions favorable for its future establishment in the study area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. Environmental Commitment 11 actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection during 2009 DHCCP surveys (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the presence of suitable habitat indicate that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Although there is minimal habitat in the Plan Area that is of appropriate width, and suitable understory to support nesting cuckoos, if western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. as described in *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, to the extent feasible, the contractor will employ best management practices to reduce construction noise during daytime and evening hours (7:00 a.m. to 10:00 p.m.) such that construction noise levels do not exceed 60 dBA (A-weighted decibel) Leq (1 hour) at the nearest western yellow-billed cuckoo migratory habitat during migration periods. Limit construction during nighttime hours (10:00 p.m. to 7:00 a.m.) such that construction noise levels do not exceed 50 dBA

Lmax[1] at the nearest residential land uses. Limit pile driving to daytime hours (7:00 a.m. to 7:00 p.m.). Locate, store, and maintain portable and stationary equipment as far as possible from suitable western yellow-billed cuckoo habitat. Employ preventive maintenance including practicable methods and devices to control, prevent, and minimize noise. Route truck traffic in order to reduce construction noise impacts and traffic noise levels within 1,200 feet of suitable western yellow-billed cuckoo migratory habitat during migration periods. Limit trucking activities (e.g., deliveries, export of materials) to the hours of 7:00 a.m. to 10:00 p.m. Screen all lights and direct them down toward work activities away from migratory habitat. A biological construction monitor will ensure that lights are properly directed at all times. Operate portable lights at the lowest allowable wattage and height, while in accordance with the National Cooperative Highway Research Program's Report 498: Illumination Guidelines for Nighttime Highway Work.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 47 acres of modeled habitat (<1% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 47acres of valley/foothill riparian habitat should be restored/created and 47acres should be protected to compensate for the losses of western yellow-billed cuckoo habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature riparian forest would be maintained within either CZ 4 (in the vicinity of Cosumnes River Preserve) or CZ 7 (in the vicinity of San Joaquin National Wildlife Refuge and Caswell State Memorial Park) to ensure that restored and protected riparian would be of sufficient size to provide suitable habitat for yellow-billed cuckoo (Resource Restoration and Performance Principle VFR2). The mature riparian forest would be intermixed with a portion of the early- to mid-successional riparian vegetation and would be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principle VFR3).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-*

Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, and by AMM1–AMM7, AMM10, and AMM22. These environmental commitments and AMMs would be in place during all project activities. Considering these commitments, losses and conversions of western yellow-billed cuckoo habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of western yellow-billed cuckoo habitat from Alternative 4A would represent an adverse effect in the absence of Environmental Commitments and AMMs as a result of habitat modification and potential for direct mortality of a special-status species. However, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principles VFR1-VFR3 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of western yellow-billed cuckoo. Therefore, Alternative 4A would have a less-than-significant impact on western yellow-billed cuckoo under CEQA.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a minimal effect on the species.

NEPA Effects: Because western yellow-billed cuckoo is not currently known to breed in the study area and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Because western yellow-billed cuckoo is not currently known to breed in the study area and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors, which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. In addition, the transmission lines that would be constructed in the vicinity of modeled western yellow-billed cuckoo habitat would be temporary and would be removed within 10–14 years of Alternative 4A implementation. Because there is low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increased risk of predation on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increased risk of predation on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on western yellow-billed cuckoo.

***CEQA Conclusion*:** The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increased risk of predation on western yellow-billed cuckoo from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of the Project on Western Yellow-Billed Cuckoo

Construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into Alternative 4A which would require a no disturbance buffer around nest sites durng the breeding season in addition to monitoring and noise reducing measures. To the extent feasible, the contractor will employ best practices to reduce construction noise during daytime and evening hours (7:00 a.m. to 10:00 p.m.) such that construction noise levels do not exceed 60 dBA (A-weighted decibel) Leq (1 hour) at the nearest western yellow-billed cuckoo migratory habitat during migration periods. Limit construction during nighttime hours (10:00 p.m. to 7:00 a.m.) such that construction noise levels do not exceed 50 dBA Lmax[1] at the nearest residential land uses. Limit pile driving to daytime hours (7:00 a.m. to 7:00 p.m.). Locate, store, and maintain portable and stationary equipment as far as possible from suitable western yellow-billed cuckoo habitat. Employ preventive maintenance including practicable methods and devices to control, prevent, and minimize noise. Route truck traffic in order to reduce construction noise impacts and traffic noise levels within 1,200 feet of suitable western yellow-billed cuckoo migratory habitat during migration periods. Limit trucking activities (e.g., deliveries, export of materials) to the hours of 7:00 a.m. to 10:00 p.m. Screen all lights and direct them down toward work activities away from migratory habitat. A biological construction monitor will ensure that lights are properly directed at all times. Operate portable lights at the lowest allowable wattage and height, while in accordance with the National Cooperative Highway Research Program's Report 498: Illumination Guidelines for Nighttime Highway Work.The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

Methylmercury Exposure: The modeled primary habitat for western yellow-billed cuckoo includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the

Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Cuckoos typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. Cuckoos are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-billed cuckoo. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in operations of water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that yellow-billed cuckoo mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have existing elevated mercury tissue levels, these low level increases could result in some level of effects. Environmental Commitment 12 would be implemented to address the risk that low level increases in methylmercury could add to the current elevated concentrations in tissue.

Because of the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults,

and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including western yellow-billed cuckoo. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, construction and operation of proposed water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on western yellow-billed cuckoo from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the western yellow-billed cuckoo population are expected to be minimal because the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects: Indirect effects on western yellow-billed cuckoo as a result of Alternative 4A implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality. Changes in water operations would not be expected to result in increased mercury bioavailability to western yellow-billed cuckoo. Restoration actions that would create high and low tidal marsh, which is western yellow-billed cuckoo habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the western yellow-billed cuckoo population. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the western yellow-billed cuckoo population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Because of the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into Alternative 4A, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Indirect effects on western yellow-billed cuckoo as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. Changes in water operations would not be expected to result in increased mercury bioavailability to western yellow-billed cuckoo. Restoration actions that would create high and low tidal marsh could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the western yellow-billed cuckoo population. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

Tidal habitat restoration could result in increased exposure of western yellow-billed cuckoo to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the western yellow-billed cuckoo population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With the incorporation of AMM1–AMM7, *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and *AMM27 Selenium Management* into Alternative 4A, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on western yellow-billed cuckoo.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

White-Tailed Kite

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen et al. 1995).

Alternative 4A would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-4A-40. The majority of the losses would result from the construction of the water conveyance facilities. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed Kite*, including the planting of mature trees. Full implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit the white-tailed kite.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7.The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum width of 330 feet where practicable (Resource Restoration and Performance Principles VFR2 and VFR3).
- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres and would also benefit white-tailed kite:
    - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres (as part of the total cultivated lands protected) (Resource Restoration and Performance Principle SH1).

- Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) (Resource Restoration and Performance Principle SH2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

White-tailed kite is a fully protected species and take of white-tailed kite individuals is prohibited under Section 3511 of the Fish and Game Code. With the implementation of *AMM39 White-Tailed Kite*, construction activities would not result in take, and effects on the species would be minimized. As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-40. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	25	16
	Foraging	3,244	1,054
Total Impacts Water Conveyance Facilities		**3,269**	**1,070**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	9	0
	Foraging	2,429	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,438**	**0**
Total Nesting		**34**	**16**
Total Foraging		**5,673**	**1,054**
TOTAL IMPACTS		**5,707**	**1,070**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 4A would result in the combined permanent and temporary loss of up to 6,777 acres of modeled habitat (50 acres of nesting habitat and 6,727 acres of foraging habitat) for white-tailed kite (Table 12-4A-40). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 41 acres of white-tailed kite nesting habitat (25 acres of permanent loss and 16 acres of temporary loss). In addition, 2,298 acres of foraging habitat would be removed (3,244 acres of permanent loss, 1,054 acres of temporary loss). Activities that would impact modeled white-tailed kite habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 1–3 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no occurrences of nesting white-tailed kite that overlap with the construction footprint of water conveyance facilities. White-tailed kite is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If white-tailed kite were to nest in or adjacent to work areas, the implementation of *AMM39 White-Tailed Kite* would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings by restricting construction activities during the breeding season or establishing suitable buffers around active nests (see Appendix3B, *Environmental Commitments, AMMs, and CMs*). Impacts on foraging habitat would occur throughout the central Delta in CZs 3–6, and CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 9 acres of white-tailed kite nesting habitat and 256 acres of foraging habitat. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *Environmental Commitment 7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 251 acres of white-tailed kite foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration:* Grassland restoration would permanently convert approximately 1,070 acres of cultivated lands suitable for foraging by white-tailed kite to grassland.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 832 acres of cultivated lands to nontidal marsh. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support

White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could remove up to 20 acres of white-tailed kite foraging habitat. Activities could also disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. The implementation of *AMM39 White-Tailed Kite* would avoid disturbance and nest abandonment by requiring restrictions on construction activities during the breeding season or establishing nodisturbance buffers.

- Permanent and temporary white-tailed kite nesting habitat losses from the above Environmental Commitments would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. Effects of operations and maintenance activities on active white-tailed kite nests would be avoided by the implementation of *AMM39 White-Tailed Kite* which would restriction activities during the breeding season or require a construction buffer to minimize disturbance. If emergency repairs were required during the breeding season that could potentially result in take, CDFW consultation would be initiated (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

- Injury and Direct Mortality: Construction-related activities would not be expected to result in take of adult or fledged white-tailed kite if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment. White-tailed kite is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If active nests were present in or adjacent to work areas, the implementation of *AMM39 White-Tailed Kite*, would restrict construction activities during the breeding season, or require a construction buffer that would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings (Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 50 acres of potential nesting habitat (<1% of the potential nesting habitat in the study area) and the loss or conversion of 6,727 acres of foraging habitat (1% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual Environmental Commitments.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 50 acres of nesting habitat should be restored/created and 50 acres should be protected to mitigate the losses of white-tailed kite nesting habitat. In addition, 6,727 acres of foraging habitat of should be protected to compensate for the losses of white-tailed kite foraging habitat.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. Project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat which would protect up to a total of 6,805 acres of white-tailed kite foraging habitat (Resource Restoration and Performance Principle SH1). These acres of cultivated lands and grasslands would be located above -1 foot above mean sea level. At least 50% of these lands would be in very high-value production for the Swainson's hawk (alfalfa) (Resource Restoration and Performance Principle SH2). These Swainson's hawk Resource Restoration and Performance Principles would be associated with Environmental Commitment 3 and would occur in the same timeframe as the construction and early restoration losses and would compensate for effects on white-tailed kite foraging habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland, which would provide nesting habitat for white-tailed kite. Though this riparian restoration would remove foraging habitat for the species (cultivated lands) it would create nesting habitat, which is more of a limiting resource in the Delta. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature, riparian forest would be maintained in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2), as part of the acres of restoration and protection under Environmental Commitment 7. In addition, small but essential nesting habitat for white-tailed kite associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Environmental Commitment 3).

The 251 acres of restored riparian habitat would be initiated to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A conservation area for every tree 20 feet or taller removed by construction. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A conservation area in areas that support high-value foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite. Further details of AMM39 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. The implementation of these AMMs, in addition to *AMM39 White-Tailed Kite*, would avoid the risk of take of individuals in habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of white-tailed kite nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, SH1, SH2, and CL1, AMM1–AMM7, AMM10, and *AMM39 White-Tailed Kite*, which would restrict construction activities during the breeding season and would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings and would be in place during all project activities. Considering these commitments, losses and conversions of white-tailed kite habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on white-tailed kite habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for take in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VFR1-VFR3, SH1, SH2, and CL1, AMM1–AMM6, AMM10, and *AMM39 White-Tailed Kite*, which would restrict construction activities during the breeding season and which would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings and would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not result in take of white-tailed kite pursuant to California Fish and Game Code Section 86. Therefore, Alternative 4A would have a less-than-significant impact on white-tailed kite under CEQA.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of take from bird strike from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce the risk of collisions with lines.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce the risk of white-tailed kites colliding with project powerlines. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on white-tailed kite.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not result in take of white-tailed kite pursuant to California Fish and Game Code Section 86 because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce the risk of white-tailed kites colliding with project powerlines. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of the Project on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. The implementation of *AMM39 White-Tailed Kite* would avoid the risk of take of individual white-tailed kites in habitats in or adjacent to work areas by restricting construction activities during the breeding season or establishing nodisturbance buffers around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, and *AMM39 White-tailed Kite*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) an restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect white-tailed kite (see BDCP Appendix 5.D, *Contaminants*). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by white-tailed kite. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite* which would avoid the risk of take of individuals. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4A implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *Environmental Commitment 12 Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*:** Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite*, which would avoid the risk of take of individuals. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *Environmental Commitment 12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in Environmental Commitment 12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4A implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on white-tailed kite.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Yellow-Breasted Chat

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking.

Alternative 4A would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-4A-41. Full implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit the yellow-breasted chat.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-41. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Nesting and Migratory Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	15	10
	Secondary	15	9
Total Impacts Water Conveyance Facilities		**30**	**19**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	6	0
	Secondary	4	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**10**	**0**
Total Primary		**21**	**10**
Total Secondary		**19**	**9**
TOTAL IMPACTS		**40**	**19**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 4A would result in the combined permanent and temporary loss of up to 59 acres of modeled nesting and migratory habitat for yellow-breasted chat (40 acres of permanent loss, 19 acres of temporary loss, Table 12-4A-41). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 25 acres of primary habitat (15 acres of permanent loss, 10 acres of temporary loss). In addition, 24 acres of secondary habitat would be removed (15 acres of permanent loss, 9 acres of temporary loss, Table 12-4A-41). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and temporary work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and 8. Most of the permanent loss of habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some habitat would be lost due to construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Permanent habitat loss would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary loss of habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation.
- Habitat loss from water conveyance facilities activities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. There are no occurrences of yellow-breasted chat that overlap with the water conveyance facilities construction footprint. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the effects of construction on nesting yellow-breasted chats if they were to occur in the area (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 6 acres of modeled yellowbreasted chat primary habitat and 4 acres of modeled yellow-breasted chat secondary habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted

chat habitats would be expected to maintain and improve the functions of the habitat. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the study area.

Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

A variety of habitat management actions included in *Environmental Commitment 11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-breasted chat use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.

- Permanent and temporary habitat losses from the above Environmental Commitments would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 59 acres of modeled habitat (less than 1% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 59 acres of valley/foothill riparian habitat should be restored/created and 59 acres should be protected to compensate for the losses of yellow-breasted chat habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of yellow-breasted chat habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and AMM22. These environmental commitments and AMMs would be in place during all project activities. Considering these commitments, losses and conversions of yellow-breasted chat habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of yellow-breasted chat habitat from Alternative 4A would represent an adverse effect in the absence of Environmental Commitments and AMMs as a result of habitat modification and potential for direct mortality of a special-status species. However, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principle VFR1 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3*

Stormwater Pollution Prevention Plan, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-breasted chat. Therefore, Alternative 4A would have a less-than-significant impact on yellow-breasted chat under CEQA.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

***NEPA Effects*:** Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

***CEQA Conclusion*:** Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions will be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

***NEPA Effects*:** The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

***CEQA Conclusion*:** The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters, which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of the Project on Yellow-Breasted Chat

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A, which would ensure 250 foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, reducing the use of an estimated 59 acres of modeled primary nesting and migratory habitat and 119 acres of secondary nesting and migratory habitat. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect on the species.

Methylmercury Exposure: The modeled primary habitat for yellow-breasted chat includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Chats typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. Chats are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix 11F, *Substantive BDCP Revisions*). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on yellow-breasted chat. Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in operations of water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that yellow-breasted chat mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have existing elevated mercury tissue levels, these low level increases could result in some level of effects. Environmental Commitment 12 would be implemented to address the that risk low level increases in methylmercury could add to the current elevated concentrations in tissue.

Because of the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-breasted chat. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, construction and operation of proposed water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on yellow-breasted chat from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the yellow-breasted chat population would be expected to be minimal because the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into Alternative 4A.

Changes in water operations would not be expected to result in increased mercury bioavailability to yellow-breasted chat. Restoration actions that would create high and low tidal marsh, which is yellow-breasted chat habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration is not expected to adversely affect the yellow-breasted chat population. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the yellow-breasted chat population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

***CEQA Conclusion*:** The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into Alternative 4A.

Changes in water operations would not be expected to result in increased mercury bioavailability to yellow-breasted chat. Restoration actions that would create high and low tidal marsh, which is yellow-breasted chat habitat, could provide biogeochemical conditions for methylation of mercury in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration is not expected to adversely affect the yellow-breasted chat population. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

Tidal habitat restoration could result in increased exposure of yellow-breasted chat to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the yellow-breasted chat population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on yellow-breasted chat.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled nesting habitat for these species is restricted to valley/foothill riparian forest.

Alternative 4A would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-4A-42. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would also benefit Cooper's hawk and osprey.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2).

As explained below, with the acres of restoration or protection included in the project, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-42. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	25	16
Total Impacts Water Conveyance Facilities		**25**	**16**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	9	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**9**	**0**
TOTAL IMPACTS		**34**	**16**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 4A would result in the combined permanent and temporary loss of up to 50 acres (34 acres of permanent loss, 16 acres of temporary loss) of modeled nesting habitat for Cooper's hawk and osprey (Table 12-4A-42). Project measures that would result in these losses are water facilities and operation (which would involve construction of water conveyance facilities and transmission lines and establishment and use of reusable tunnel material areas), and tidal restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other Alternative 4A physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 41 acres of modeled Cooper's hawk and osprey habitat (Table 12-4A-42). Of the 41 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 25 acres would be a permanent loss and 16 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and work areas. Most of the permanent loss of nesting habitat would occur where Intakes 1–3 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from water conveyance facilities would occur in the central Delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. These losses would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for water conveyance facilities; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on Cooper's hawk and osprey if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration would permanently remove up to 9 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

- Permanent and temporary habitat losses from the above Environmental Commitments would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 50 acres of potential nesting habitat (less than 1% of the potential nesting habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat. Using these ratios would indicate that 50 acres of nesting habitat should be restored/created and 50 acres should be protected to mitigate the losses of Cooper's hawk and osprey nesting habitat.

The 251 acres of restored riparian habitat would be initiated to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Cooper's hawk or osprey. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Cooper's hawk or osprey nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A conservation area for every tree 20 feet or taller removed by construction. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A conservation area in areas that support high-value Swainson's hawk foraging habitat to increase nest sites, or within riparian plantings as a component of the riparian restoration (Environmental Commitment 7). Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of Cooper's hawk and osprey nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of Cooper's hawk and osprey habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on Cooper's hawk and osprey habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM6, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Cooper's hawk and osprey. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on Cooper's hawk and osprey under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the flight behavior, the general maneuverability, and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of the Project on Cooper's Hawk and Osprey

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect cooper's hawk and osprey, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

The potential mobilization or creation of methylmercury within the project area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by

interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Cooper's hawk and osprey. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on Cooper's hawk and osprey from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the species populations would be expected to be minimal because the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could adversely affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, in addition to AMM1–AMM7, would be available to address this adverse effect.

Tidal habitat restoration could result in increased exposure of Cooper's hawk and osprey to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect species populations. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Cooper's hawk and osprey.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. This would be a significant impact. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Cooper's hawk and osprey.

Tidal habitat restoration also could result in increased exposure of Cooper's hawk and osprey to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect species populations. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of Cooper's hawk or osprey. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on Cooper's hawk or osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on Cooper's hawk and osprey.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Alternative 4A would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-4A-43. Full implementation of Alternative 4A would include the following Environmental Commitments that would benefit golden eagles or ferruginous hawk.

- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitments 3 and Environmental Commitment 8).
- Protect up to 11,870 acres of cultivated lands (Environmental Commitment 3).
- Restore up to 48 acres and protect up to 188 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).

Golden eagle is a fully protected species and California Fish and Game Code Section 86 prohibits take of individuals. With the implementation of *AMM20 Greater Sandhill Crane*, construction activities would not result in mortality of the species, which would avoid take pursuant to Section 86 of the California Fish and Game Code. As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-43. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Foraging	1,978	537
Total Impacts Water Conveyance Facilities		**1,978**	**537**
Environmental Commitments 4, 6–7, 9–11[a]	Foraging	2,427	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,427**	**0**
TOTAL IMPACTS		**4,405**	**537**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 4A would result in the combined permanent and temporary loss of up 4,942 acres of modeled foraging habitat for golden eagle and ferruginous hawk (4,405 acres of permanent loss and 537 of temporary loss, Table 12-4A-43). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), vernal pool and alkalai seasonal wetland restoration (Environmental Commitment 9) and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate foraging habitat for both species. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled golden eagle and ferruginous hawk habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 1,115 acres would be affected by placement of an reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Some of the grassland habitat lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which is also suitable foraging habitat for the species. There are no occurrences of golden eagle or ferruginous hawk that intersect with the water conveyance facilities footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 254 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of golden eagle and ferruginous hawk foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for foraging raptors but would not permanently reduce foraging habitat for either species.

- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* The intent of the Environmental Commitment is to match the acreage of restoration with the actual acreage lost to other project measures (primarily water conveyance facilities). The current estimate for vernal pool/alkali seasonal wetland complex restoration is 48 acres. The goal is for no net loss of this natural community, consistent with the project's Resource Restoration and Performance Principles. These acres may be temporarily unavailable for foraging raptors but the project would not permanently reduce foraging habitat for either species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of golden eagle and ferruginous hawk foraging habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 20 acres and temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat for these species.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,942 acres of modeled golden eagle and ferruginous hawk foraging habitat. These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,884 acres should be protected to compensate for the losses of golden eagle and ferruginous hawk habitat. Project proponents would commit to protect up to 1,060 acres of grassland, 188 acres of vernal pool/alkali seasonal wetland complex, and 11,870 acres of cultivated lands, and to restore up to 1,070 acres of grassland and 48 acres of vernal pool/alkali seasonal wetland complex which would provide suitable habitat for golden eagle and ferruginous hawk.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and

species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of golden eagle and ferruginous hawk foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by and by AMM1–AMM7, which would be in place during all project activities. Considering these commitments, losses and conversions of mountain plover habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on golden eagle and ferruginous hawk foraging habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. These conservation activities would be guided by and by AMM1–AMM7, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications. Therefore, Alternative 4A would have a less-than-significant impact on golden eagle and ferruginous hawk under CEQA.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce the potential for powerline collisions.

NEPA Effects: Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

CEQA Conclusion: Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to fit new transmission lines constructed as a result of the project with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, there would be no take of golden eagle from the project pursuant to California Fish and Game Code Section 86, and the construction and operation of transmission lines would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-115: Indirect Effects of the Project on Golden Eagle and Ferruginous Hawk

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat. With the incorporation of AMM1–AMM7 into Alternative 4A, indirect effects as a result of Alternative 4A implementation would not have an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into Alternative 4A, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on golden eagle and ferruginous hawk.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Alternative 4A would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-4A-44. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit cormorants, herons, and egrets.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitment 3 and Environmental Commitment 10).
- Restore or create up to 295 acres of tidal wetlands in the Delta (Environmental Commitment 4)
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, Mitigation Measure BIO-75, and Mitigation Measure BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-44. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting (Rookeries)	37	24
Total Impacts Water Conveyance Facilities		**37**	**24**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting (Rookeries)	11	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**11**	**0**
TOTAL IMPACTS		**48**	**24**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 4A would result in the combined permanent and temporary loss of up to 72 acres of modeled nesting habitat (48 acres of permanent loss, 24 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-4A-44). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal natural communities restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 61 acres of modeled nesting habitat for cormorants, herons, and egrets. (Table 12-4A-44). Of the 61 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 37 acres would be a permanent loss and 24 acres would be a temporary loss of habitat. Activities that would impact modeled nesting habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities, and temporary work areas. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost as a result of construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and CZ 8. Habitat loss from water conveyance facilities activities would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no CNDDB or DHCCP occurrences of nesting cormorants, herons, or egrets that overlap with the construction footprint of water conveyance facilities; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds* and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to minimize impacts on cormorants, herons and egrets if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 11 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

- Permanent and temporary habitat losses from the above Environmental Commitments would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.

- *Construction Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. To avoid adverse effects on these species, existing known nest sites would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries,* would be available to address these adverse effects on cormorants, herons, and egrets.

- Injury and Direct Mortality: If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests including any nests that are built on the ground (e.g. Cormorant nests that have been built on the ground after nest trees fall over or die from stress and guano produced by a rookery) or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address these effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 72 acres of potential breeding habitat (<1% of the potential breeding habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat. Using these ratios would indicate that 72 acres of nesting habitat should be restored/created and 72 acres should be protected to mitigate the losses of cormorant, heron, and egret nesting habitat.

The 251 acres of restored riparian habitat would be initiated in the first 10 years to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by cormorants, herons, and egrets. This time lag between the removal and restoration of nesting habitat could have a substantial impact on cormorants, herons, and egrets. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active cormorant, heron, and egret nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal, to compensate for the temporal loss of Swainson's hawk nest sites, defined as a 125-acre area where more than 50% of suitable nest trees (20 feet or taller) within the 125-acre block are removed. These mature trees would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A conservation area for every tree 20 feet or taller removed by construction. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A conservation area to increase Swainson's hawk nest sites, or within riparian plantings as a component of the riparian restoration (Environmental Commitment 7). Further details of AMM18 are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of cormorant, heron, and egret nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of cormorant, heron, and egret habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on cormorant, heron, and egret habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM6, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of cormorants, herons, or egrets. Therefore, with the implementation of Mitigation Measure BIO-75 and Mitigation Measure BIO-117, Alternative 4A would have a less-than-significant impact on cormorants, herons, and egrets under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid direct impacts on rookeries and avoid or minimize indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters, which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would a less-than-significant impact on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of the Project on Cormorants, Herons and Egrets

Indirect Construction- and Operation-Related Effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets. Future operational impacts under water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect cormorants, herons or egrets, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. This would be a significant impact. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With AMM1–AMM7, AMM27, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of cormorants, herons, and egrets. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries), therefore all direct and indirect impacts on rookeries must be avoided.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on cormorants, herons, and egrets.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands (grain and hay crops, pasture [including alfalfa], rice, truck, nursery, and berry crops [including tomatoes and melons], beets, and idle lands).

Alternative 4A would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-4A-45. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit short-eared owl and northern harrier.

- Restore or create up to 295 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create up to 13.5 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres at a location subject to CDFW approval (Resource Restoration and Performance Principle CBR1).
- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitment 3 and Environmental Commitment 10).
- Restore up to 1,070 acres of grasslands (Environmental Commitment 8).
- Restore up to 48 acres and protect up to 188 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).
- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres:

- ○ Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in patch sizes of a minimum of 40 acres (Resource Restoration and Performance Principle SH1).
- ○ Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) (Resource Restoration and Performance Principle SH2).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species, AMM1–AMM7, *AMM27 Selenium Management* and Mitigation Measure BIO-75, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-45. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting and Foraging	2,231	724
Total Impacts Water Conveyance Facilities		**2,231**	**724**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting and Foraging	2,232	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,232**	**0**
TOTAL IMPACTS		**4,463**	**724**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 4A would result in the combined permanent and temporary loss of up to 5,187 acres of modeled habitat for short-eared owl and northern harrier (of which 4,463 acres would be a permanent loss and 724 acres would be a temporary loss of habitat, Table 12-4A-45). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,955 acres of modeled short-eared owl and northern harrier habitat (2,231 acres of permanent loss, 745 acres of temporary loss) from CZs 3–6 and CZ 8. Activities that would impact modeled habitat include tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary work areas. The majority of habitat removed would consist of grassland and alfalfa fields. There are no CNDDB or DHCCP surveys records of occurrences of nesting short-eared owl that overlap with the construction footprint of water conveyance facilities. However, there are two DHCCP occurrences of northern harrier that overlap with the footprint of a shaft associated with the pumps at Clifton Court Forebay and a permanent transmission line north of the forebay. Two DHCCP occurrences also overlap with the temporary impact footprint from geotechnical explorations. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on short-eared owl and northern harrier if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal restoration actions through Environmental Commitment 4 would restore up to an estimated 253 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the value of their nesting habitat.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of short-eared owl and northern harrier foraging habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for foraging short-eared owl and northern harrier but would not permanently reduce foraging habitat for either species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of short-eared owl and northern harrier foraging habitat. Some portion of nontidal marsh restoration would be expected to provide habitat for both species.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove up to 20 acres and temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have adverse effects on available habitat but would be expected to result in overall improvements to and maintenance of habitat values. Habitat management- and enhancement-related activities could affect short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize these adverse effects.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee

and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and Mitigation Measure BIO-75 as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 4A would result in the permanent loss of and temporary effects on 5,187 acres of modeled habitat for short-eared owl and northern harrier (<1% of the modeled habitat in the study area). Of the 5,187 acres of modeled habitat impacted, 77 acres consist of wetlands.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by water conveyance facilities would be 1:1 protection of non-wetland habitats and 1:1 protection and 1:1 restoration of wetland habitat. Using these typical ratios would indicate that 5,106 acres of grassland and cultivated lands should be protected, 81 acres of wetlands should be restored or created, and 81 acres of wetlands should be protected to compensate for the losses of short-eared owl and northern harrier habitat.

Short-eared owl and northern harrier nest in tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands, which includes alfalfa, irrigated pasture, and other grain fields. A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. Within these acres of grassland and cultivated lands protection, project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (Resource Restoration and Performance Principle SH1), which would total 6,717 acres and would also be suitable foraging habitat for short-eared owl and northern harrier. These acres of cultivated lands and grasslands would be located above 1 foot above mean sea level and at least 50% of these lands would be in very high-value production for the Swainson's hawk (alfalfa) (Resource Restoration and Performance Principle SH2).

In addition, 295 acres of tidal natural communities would be restored or created, 119 acres of nontidal wetlands would be protected, 832 acres of nontidal wetlands would be created in the Delta, 1,070 acres of grassland would be restored, and 48 acres of vernal pool complex would be restored. The restored and protected acres described above would provide suitable nesting and foraging habitat for these species. Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 8, Environmental Commitment 9, and Environmental Commitment 10 would occur in the same timeframe as the construction and early restoration losses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

For the project to avoid adverse effects on individuals, preconstruction surveys would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of short-eared owl and northern harrier nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles CBR1, SH1, and SH2, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of short-eared owl and northern harrier habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on short-eared owl and northern harrier habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles CBR1, SH1, and SH2, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of short-eared owl and northern harrier. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on short-eared owl and northern harrier under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would further reduce any bird strike risk of short-eared owl and northern harrier.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% amd which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on short-eared owl or northern harrier.

CEQA Conclusion: The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60% and which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4A would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of the Project on Short-Eared Owl and Northern Harrier

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix 11F, *Substantive BDCP Revisions*, which includes an overview of the Alternative 4A-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 will be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on short-eared owl and northern harrier as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of Environmental Commitments and AMMs. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on short-eared owl and northern harrier.

CEQA Conclusion: Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on short-eared owl and northern harrier and their habitat as a result of Alternative 4A implementation would represent a substantial adverse effect in the absence of Environmental Commitments and AMMs. This impact would be significant. The incorporation of AMM1–AMM7 into Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could also result in increased exposure of short-eared owl and northern harrier to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on short-eared owl and northern harrier.

Indirect effects of Alternative 4A implementation would represent an adverse effect on short-eared owl and northern harrier in the absence of other Environmental Commitments. This would be a significant impact. With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on short-eared owl and northern harrier.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are generally discussed for waterfowl in the *General Terrestrial Biology*, section under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013). Tule greater white-fronted goose is currently only known to occur in Susiun Marsh and there are no proposed project activities that would affect habitats in Suisun Marsh under Alternative 4A.

Mountain Plover

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on mountain plover. Mountain plover does not breed in California, but winters in the study area. Modeled habitat for mountain plover include grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Alternative 4A would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-4A-46. Full implementation of Alternative 4A would include the following Environmental Commitments which could benefit the mountain plover.

- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitments 3 and Environmental Commitment 8).
- Protect up to 11,870 acres of cultivated lands (Environmental Commitment 3).
- Restore up to 48 acres and protect up to 188 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).

As explained below, with the restoration or protection of these amounts of habitat, in addition to AMM1-AMM7, management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-46. Changes in Mountain Plover Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Wintering	1,978	537
Total Impacts Water Conveyance Facilities		1,978	537
Environmental Commitments 4, 6–7, 9–11[a]	Wintering	2,427	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,427**	**0**
TOTAL IMPACTS		**4,405**	**537**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 4A would result in the combined permanent and temporary loss of up to 4,942 acres of modeled wintering habitat for mountain plover (4,405 acres of permanent loss and 537 of temporary loss, Table 12-4A-46). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled mountain plover habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable habitat for the species. Approximately 1,115 acres would be affected as a result of the placement of an reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. There are no CNDDB occurrences of mountain plover that intersect with the water conveyance facilities footprint. However, the study area does overlap with the wintering range for the species. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 254 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of mountain plover wintering habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for mountain plover but would not permanently reduce foraging habitat for the species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of mountain plover wintering habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 20 acres and temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available mountain plover habitat. Management of grasslands and cultivated lands for mountain plover such as grazing or mowing would make habitat temporarily unavailable for the species but would ultimately make the habitat more suitable for mountain plover.

- *Water Conveyance Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,942 acres of modeled mountain plover wintering habitat. These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,884 acres should be protected to compensate for the losses of mountain plover wintering habitat. Due to the conservative nature of the impact analysis, both grassland and cultivated lands were included in the impact model, however, only 686 acres of impact would be from loss of grasslands, some of which would be suitable for mountain plover. Project proponents would commit to protect up to 1,060 acres of grassland, 188 acres of vernal pool/alkali seasonal wetland complex, and 11,870 acres of cultivated lands, and to restore up to 1,070 acres of grassland and 48 acres of vernal pool/alkali seasonal wetland complex which could provide suitable wintering habitat for mountain plover. *Environmental Commitment 11 Natural Communities Enhancement and Management* would be implemented to ensure that sufficient acres of grassland and cultivated lands were managed to provide suitable habitat for mountain plover and other species with similar habitat requirements.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of mountain plover wintering habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. AMM1–AMM7 would be in place during all project activities. Considering these commitments, losses and conversions of mountain plover habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on mountain plover wintering habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. AMM1–AMM7 would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, Alternative 4A would have a less-than-significant impact on mountain plover under CEQA.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

NEPA Effects: New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines, would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on mountain plover.

CEQA Conclusion: New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane,* which would require the installation of bird flight diverters on all new transmission lines, would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of the Project on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover wintering habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects**:** Indirect effects on mountain plover as a result of Alternative 4A implementation could have adverse effects on the species through the modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4A implementation would not have an adverse effect mountain plover.

CEQA Conclusion: Indirect effects on mountain plover as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on mountain plover.

NEPA Effects**:** No effect.

CEQA Conclusion**:** No impact.

Black Tern

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Alternative 4A would not result in effects on modeled habitat for black tern as indicated in Table 12-4A-47. There is no modeled habitat for the species in the water conveyance facilities footprint and proposed areas of tidal restoration under Alternative 4A.

Table 12-4A-47. Changes in Black Tern Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

No habitat would be lost or converted and there would be no direct mortality of black tern under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Conservation Zone 2, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Impact BIO-129b: Indirect Effects of the Project on Black Tern

No indirect effects on black tern were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Conservation Zone 2, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on black tern habitat under Alternative 4A.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of breeding habitat in the project area, which includes grassland vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture. Alternative 4A would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-4A-48. Full implementation of Alternative 4A would include the following Environmental Commitments which could benefit the California horned lark and the grasshopper sparrow.

- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitments 3 and Environmental Commitment 8).
- Protect up to 11,870 acres of cultivated lands (Environmental Commitment 3).
- Restore up to 48 acres and protect up to 188 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-48. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Breeding	1,978	537
Total Impacts Water Conveyance Facilities		**1,978**	**537**
Environmental Commitments 4, 6–7, 9–11[a]	Breeding	2,427	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,427**	**0**
TOTAL IMPACTS		**4,405**	**537**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 4A would result in the combined permanent and temporary loss of up to 4,942 acres of modeled nesting habitat for California horned lark and grasshopper sparrow (of which 4,405 acres would be a permanent loss and 537 acres would be a temporary loss of habitat, Table 12-4A-48). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of modeled California horned lark and grasshopper sparrow habitat (1,978 acres of permanent loss, 537 acres of temporary loss). Impacts would result from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 1,115 acres would be affected as the result of the placement of an reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 2 and 3 (6 occurrences), in the Stone Lakes NWR. However, the water conveyance facilities footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. Mitigation Measure BIO-75, *Conduct*

Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting California horned larks or grasshopper sparrows. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 254 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of California horned lark and grasshopper sparrow habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for California horned lark and grasshopper sparrow during restoration, but would not permanently reduce habitat availability for either species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of California horned lark and grasshopper sparrow habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 20 acres and temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation (mechanical or grazing) and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values for California horned lark and grasshopper sparrow.

- Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and Mitigation Measure BIO-75 as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,942 acres of modeled California horned lark and grasshopper sparrow habitat. These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,884 acres should be protected to compensate for the losses of California horned lark and grasshopper sparrow habitat. Due to the conservative nature of the impact analysis, both grassland and cultivated lands were included in the impact model, however, only 686 acres of impact would be from loss of grasslands, some of which would be suitable for horned lark and grasshopper sparrow. Project proponents would commit to protect up to 1,060 acres of grassland, 188 acres of vernal pool/alkali seasonal wetland complex, and 11,870 acres of cultivated lands, and to restore up to 1,070 acres of grassland and 48 acres of vernal pool/alkali seasonal wetland complex, which could provide suitable habitat for California horned lark and grasshopper sparrow. *Environmental Commitment 11 Natural Communities Enhancement and Management* would be implemented to ensure that sufficient acres of grassland and cultivated lands were managed to provide suitable habitat for California horned lark, grasshopper sparrow, and other species with similar habitat requirements.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of California horned lark and grasshopper sparrow habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. AMM1–AMM7 would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of California horned lark and grasshopper sparrow under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on California horned lark and grasshopper sparrow habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. AMM1–AMM7 would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of California horned lark and grasshopper sparrow. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on California horned lark and grasshopper sparrow under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. *AMM20 Greater Sandhill Crane* would minimize the risk of bird strikes by installing flight-diverters on new and selected existing powerlines.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane*, the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane*, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of the Project on California Horned Lark and Grasshopper Sparrow

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to California horned lark and grasshopper sparrow nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. Potential mortality of California horned lark and grasshopper sparrow would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4A implementation could have a significant impact on these species. The incorporation of AMM1–AMM7 into Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on California Horned Lark and Grasshopper Sparrow as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on California horned lark or grasshopper sparrow.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis includes tidal freshwater, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZ 2, 4, and 11. Alternative 4A would result in both temporary and permanent losses of modeled habitat for least bittern and white-faced ibis as indicated in Table 12-4A-49. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles that would also benefit least bittern and white-faced ibis.

- Restore or create up to 13.5 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta (Environmental Commitment 4 and Resource Restoration and Performance Principle CBR1).

- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, and *AMM27 Selenium Management* and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-49. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	1	3
Total Impacts Water Conveyance Facilities		**1**	**3**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**6**	**3**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 4A would result in the combined permanent and temporary loss of up to 11 acres of modeled habitat for least bittern and white-faced ibis (6acres of permanent loss and 3 of temporary loss, Table 12-4A-49). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 4 acres of modeled least bittern and white-faced ibis habitat (1 acre of permanent loss, 3 acres of temporary loss) from CZ 4. Permanent impacts on habitat would result from an reusable tunnel material storage site north of Twin Cities Road and east of the intermediate forebay. Temporary impacts would result from the construction of two temporary transmission lines, one extending east along Lambert Road from the Lambert Road Vent Shaft, and one extending south from the Lambert Road Vent Shaft to the intermediate forebay. The construction footprint for water conveyance facilities does not overlap with any occurrences of least bittern or white-faced ibis. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on least bittern and white-faced ibis if they were to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of modeled least bittern and white-faced ibis habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce effects.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Construction-related activities could also flush least bittern adults from nests and lead to collision with man-made objects (Sterling 2008). Mitigation Measure BIO-75 would require preconstruction surveys in and adjacent to work areas and, if nests were present, nodisturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would result in the permanent loss of and temporary effects on 9 acres (6 acres of permanent loss, 3 acres of temporary loss) of least bittern and white-faced ibis habitat.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 9 acres of habitat should be restored and 9 acres of habitat should be protected to compensate for the losses of least bittern and white-faced ibis habitat.

Alternative 4A includes the following conservation commitments: 13.5 acres of tidal freshwater emergent wetland would be restored or created (Resource Restoration and Performance Principle CBR1) and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created. These would be implemented as part of Environmental Commitment 4, and Environmental Commitment 10 and would be more than sufficient to compensate for impacts on least bittern and white-faced ibis habitat.

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM7 Barge Operations Plan.*

If least bittern or white-faced ibis were to nest in or adjacent to work areas, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address this potentially adverse effect.

- ***NEPA Effects***: The loss of least bittern and white-faced ibis nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of least bittern and white-faced ibis habitat under Alternative 4A would not be adverse.

CEQA Conclusion:

- The effects on least bittern and white-faced ibis habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1 and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of least bittern and white-faced ibis. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on least bittern and white-faced ibis under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters which would reduce bird strike risk of least bittern and white-faced ibis.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on least bittern and white-faced ibis.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of the Project on Least Bittern and White-Faced Ibis

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-44, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could adversely affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix 11F, *Substantive BDCP Revisions.* The review includes an overview of the Alternative 4A-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of Environmental Commitments and AMMs. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of Alternative 4A implementation, would represent a substantial adverse effect in the absence of other Environmental Commitments and AMMs. This impact would be significant. The incorporation of AMM1–AMM7 into Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct*

Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would reduce this impact to a less-than-significant level. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of Alternative 4A implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other Environmental Commitments. This would be a significant impact. With AMM1–AMM7, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on least bittern or white-faced ibis.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Loggerhead Shrike

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation or nesting and perching vegetation structures. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Alternative 4A would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-4A-50. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit loggerhead shrike.

- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres.
  - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in patch sizes of a minimum of 40 acres (Resource Restoration and Performance Principle SH1).
  - Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) production (Resource Restoration and Performance Principle SH2).
- Of the 1,060 acres of grasslands protected, protect up to 227 acres of grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Resource Restoration and Performance Principle RBR5).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).
- Restore up to 1,070 acres of grasslands (Environmental Commitment 8).
- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, AMM10, and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-50. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	High-value	1,978	537
	Low-value	1,269	441
Total Impacts Water Conveyance Facilities		**3,247**	**978**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	2,239	0
	Low-value	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,239**	**0**
Total High-value		**4,217**	537
Total Low-value		**1,269**	441
TOTAL IMPACTS		**5,486**	**978**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 4A would result in the combined permanent and temporary loss of up to 6,457 acres of modeled habitat for loggerhead shrike (of which 4,747 acres is of high-value and 1,710 acres is of low value, Table 12-4A-50). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,515 acres of high-value loggerhead shrike habitat (1,978 acres of permanent loss, 537 acres of temporary loss). In addition, 1,710 acres of low-value habitat would be removed (1,269 acres of permanent loss, 441 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; construction of the intermediate forebay; and from a an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 1,115 acres would be affected by the placement of and reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*.

Loggerhead shrikes nest in high abundance in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*). Impacts from water conveyance facilities that overlap with recorded loggerhead shrike nest occurrences (from CNDDB and DHCCP surveys) include the construction of the new forebay (5 occurrences), the reusable tunnel material storage area north-west of the existing forebay (2 occurrences), permanent transmission line south of Clifton Court Road and west of the existing Clifton Court Forebay (1 occurrence), a permanent transmission line that extends along the northern extent of the reusable tunnel material storage areas west of the existing forebay (1 occurrence). Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting loggerhead shrikes. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 66 acres of high-value loggerhead shrike habitat.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of high-value loggerhead shrike habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for loggerhead shrike but would not permanently reduce foraging habitat for the species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of high-value loggerhead shrike habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could permanently remove 20 acres and temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. Fences (e.g., barbed wire) installed as part of Environmental Commitment 11, in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities.

Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and Mitigation Measure BIO-75 as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A as a whole would result in the permanent loss of and temporary effects on 4,747 acres of high-value loggerhead shrike habitat and 1,710 acres of low-value loggerhead shrike habitat. These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*. The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 9,494 acres should be protected to compensate for the loss of high-value habitat. The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats. In addition, *AMM10 Restoration of Temporarily Affected Natural Communities* would require that temporary impacts on riparian habitat, grasslands with trees and shurbs available for nestings, and cultivated lands would be restored relatively quickly after completion of construction.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected and 1,070 acres of grassland would be restored through *Environemntal Commitment 3* and *Environmental Commitment 8*. As part of these acres of protection, project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat, which would total 6,805 acres and would be located above 1 foot above mean sea level (Resource Restoration and Performance Principle SH1). At least 50% of protected Swainson's hawk foraging habitat would be in very high-value production (Resource Restoration and Performance Principle SH2) (alfalfa) which would also provide suitable high-value habitat for loggerhead shrike. Alternative 4A also contains Resource Restoration and Performance Principle CL1 to maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides which provide nesting habitat for loggerhead shrike. Resource Restoration and Performance Principal RBR5 would protect up to 227 acres of grasslands on the landward sides of levees adjacent to restored floodplain which would also benefit loggerhead shrike. These Resource Restoration and Performance Principles would be associated with Environmental

Commitment 3 and would occur in the same timeframe as the construction and early restoration losses and would benefit loggerhead shrike.

Alternative 4A also includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and loggerhead shrike habitat adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Preconstruction surveys for loggerhead shrike would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of loggerhead shrike habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, Environmental Commitment 8, and Environmental Commitment 11. These conservation actions would be guided by Resource Restoration and Performance Principles SH1, SH2, CL1, RBR5, and VFR1, and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of loggerhead shrike habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on loggerhead shrike habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement (including the maintenance of important habitat characteristics such as trees and shrubs) associated with Environmental Commitment 3, Environmental Commitment 7, Environmental Commitment 8, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles SH1, SH2, CL1, RBR5, and VFR1, and by AMM1–AMM6, AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18*

Swainson's Hawk, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of loggerhead shrike. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on loggerhead shrike under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body; its lack of flocking behavior, and its diurnal foraging behavior, contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects: Loggerhead shrike's small, relatively maneuverable body,; its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on loggerhead shrike.

CEQA Conclusion: Loggerhead shrike's small, relatively maneuverable body, its lack of flocking behavior, and its diurnal foraging behavior contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of the Project on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on loggerhead shrike as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The potential for mortality of loggerhead shrike would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 4A implementation could have a significant impact on these species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on loggerhead shrike.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Song Sparrow "Modesto" Population

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on Modesto song sparrow. The Modesto song sparrow is common and ubiquitous throughout the project area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Alternative 4A would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-4A-51. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would benefit Modesto song sparrow.

- Restore or create up to 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect up to 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore or create up to 295 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create up to 13.5 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres at a location subject to CDFW approval (Resource Restoration and Performance Principle CBR1).
- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).

As explained below, with the restoration or protection of these amounts of habitat, with AMM1–AMM7 and *AMM10 Restoration of Temporarily Affected Natural Communities* in place, and with the implementation of Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-51. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	56	63
Total Impacts Water Conveyance Facilities		**56**	**63**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	31	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**31**	**0**
TOTAL IMPACTS		**87**	**63**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 4A would result in the combined permanent and temporary loss of up to 150 acres of modeled habitat for Modesto song sparrow (87 acres of permanent loss and 63 acres of temporary loss, Table 12-4A-51). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require a period of time for ecological succession to occur for restored riparian habitat to functionally replace habitat that has been affected. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 119 acres of modeled Modesto song sparrow habitat (56 acres of permanent loss, 63 acres of temporary loss) from CZs 3–6 and CZ 8. The water conveyance facilities construction footprint overlaps with 77 Modesto song sparrow occurrences and the species is ubiquitous throughout the Delta. The reusable tunnel material storage areas throughout the central Delta overlap with 24 occurrences, shaft locations along the tunnel alignment overlap with 9 occurrences, the permanent transmission line overlaps with 6 occurrences, and 1 occurrence overlaps with the construction of the new forebay in CZ 8. In addition, areas temporarily affected overlap with species occurrences, including the construction of a transmission line (1 occurrence) and geotechnical exploration zones along the tunnel alignment (17 occurrences). Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Construction of the water conveyance facilities and the resultant impacts would occur within the first 10–14 years of Alternative 4A implementation.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated 31 acres of Modesto song sparrow riparian habitat.
- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values.

  Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If the species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 150 acres of modeled habitat (87 permanent, 63 temporary) for Modesto song sparrow in the study area. These effects would result from the construction of the water conveyance facilities and implementing *Environmental Commitment 4 Tidal Natural Communities Restoration*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 150 acres of suitable habitat should be restored/created and 150 acres should be protected to compensate for the losses of 150 acres of Modesto song sparrow habitat. Habitat that would be restored or protected to benefit Modesto song sparrow would include valley/foothill riparian and tidal and nontidal wetlands.

Alternative 4A includes conservation commitments through *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Community Restoration*, and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create up to 251 acres and protect up to 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. In addition, 295 acres of tidal wetlands would be restored or created, 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created.

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan.*

If Modesto song sparrow were to nest in or adjacent to work areas, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address this potentially adverse effect.

NEPA Effects: The loss of Modesto song sparrow nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of Modesto song sparrow habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on Modesto song sparrow habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 7, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM6, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on Modesto song sparrow under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

NEPA Effects: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

CEQA Conclusion: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow population.

Impact BIO-144: Indirect Effects of the Project on Modesto Song Sparrow

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*). However, there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 including *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect Modesto song sparrow, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

The potential mobilization or creation of methylmercury within the project area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including Modesto song sparrow. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on Modesto song sparrow from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the Modesto song sparrow population would be expected to be minimal as the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects: Noise and visual disturbances from the construction of water conveyance facilities could reduce Modesto song sparrow use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could adversely affect

Modesto song sparrow use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, in addition to AMM1–AMM7, would be available to address this adverse effect.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the Modesto song sparrow population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of Modesto song sparrow to methylmercury in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Modesto song sparrow.

CEQA Conclusion: Noise and visual disturbances from the construction of water conveyance facilities could reduce Modesto song sparrow use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Modesto song sparrow use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on Modesto song sparrow with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of Modesto song sparrow to methylmercury in tidally restored areas. This would be a significant impact. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Modesto song sparrow.

Tidal habitat restoration could result in increased exposure of Modesto song sparrow to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the Modesto song sparrow population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on Modesto song sparrow.

NEPA Effects**:** No effect.

CEQA Conclusion**:** No impact.

Bank Swallow

This section describes the effects of Alternative 4A, including construction and implementation of Environmental Commitments, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70–90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Alternative 4A would not result in the direct loss of modeled habitat for bank swallow. However, indirect effects of noise and visual disturbance from *Environmental Commitment 4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat.

As explained below, impacts on bank swallow under Alternative 4A would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-4A-52. Changes in Bank Swallow Modeled Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments[b]	Nesting	0	0
Total Impacts Environmental Commitments		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, for a detailed breakdown of Environmental Commitments' effects.
[b] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-146: Indirect Effects of Implementation of Alternative 4A on Bank Swallow

Noise and visual disturbances during restoration activities from *Environmental Commitment 4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *Environmental Commitment 11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

NEPA Effects: Construction activities associated with habitat restoration could adversely affect bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in adverse effects on bank swallows including abandonment of nests if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this effect.

CEQA Conclusion: Construction activities associated with habitat restoration could represent an adverse effect on bank swallow colonies as a result of modification of habitat and potential mortality of special status species in the absence of other measures. This impact would be significant. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, project proponents will not conduct restoration activities during the bank swallow nesting season (April 1 through August 31). If restoration activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, DWR will establish a nondisturbance buffer (determined by DWR in consultation with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the swallows have nested and laid eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses that resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento River (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Chapter 5, Section 5.3.1, *Methods for Analysis*, a description of the model).

On the Sacramento River at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 4A could increase between April and August in below normal, dry, and critical years based on modeling assumptions and output (see Table 1 in Section 11C.4.1.1 and Table 3 in Section 11C.4.1.2 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*). The increased flows could lead to inundation of active colonies. However, model outputs indicate that flows under Existing Conditions and the predicted flows in year 50 without the project (NAA) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (see Table 15 in Section 11C.4.1.8 and Table 17 in Section 11C.4.1.9 of Appendix 11C). In addition, at the Verona flow gauge on the Sacramento River in average water years (see Table 7 in Section 11C.4.1.4 of Appendix 11C) flows are predicted to be greater than 14,000 cfs during the breeding season (April through August,) which could lead to bank collapse. However, flows of this height are recorded under Existing Conditions at this flow gage and are also predicted at year 50 without the project (NAA).

NEPA Effects: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4A would not differ substantially from those under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

CEQA Conclusion: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4A would not differ substantially from those under Existing Conditions. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will continue to support annual monitoring[3] of existing colonies upstream of the study area. DWR will collect data to be used for quantifying the magnitude of flows that would result inloss of active nest sites or degradation of available nesting habitat, and the extent to which changes in SWP operations attributable solely to the California WaterFix are the cause of such impacts. If DWR determines that changes in SWP operations attributable solely to the California WaterFix have caused loss of active nest sites or degradation of available nesting habitat, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of Environmental Commitments, on yellow-headed blackbird. The

[3] Bank swallow colonies have historically been and are currently monitored by DWR, USFWS, and CDFW in association with the Bank Swallow Technical Advisory Committee, which is a diverse coalition of state and federal agency and nongovernmental organization personnel, created in response to the continued decline of bank swallow populations on the Sacramento River.

habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. These natural communities support aquatic insects which are important prey items for yellow-headed blackbird young (Beedy 2008). Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Alternative 4A would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-4A-53. Full implementation of Alternative 4A would include the following Environmental Commitments and Resource Restoration and Performance Principles which would also benefit yellow-headed blackbird.

- Restore or create up to 295 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create up to 13.5 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres at a location subject to CDFW approval (Environmental Commitment 4 and Resource Restoration and Performance Principle CBR1)
- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).
- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, Environmental Commitment 12, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-53. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	19	39
	Foraging	2,652	656
Total Impacts Water Conveyance Facilities		**2,671**	**695**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	21	0
	Foraging	2,239	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,260**	**0**
Total Nesting		**40**	**39**
Total Foraging		**4,891**	**656**
TOTAL IMPACTS		**4,931**	**695**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 4A would result in the combined permanent and temporary loss of up to 5,626 acres of modeled habitat (79 acres of nesting habitat and 5,547 acres of foraging habitat) for yellow-headed blackbird (Table 12-4A-53). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 58 acres of yellow-headed blackbird nesting habitat (19 acres of permanent loss and 39 acres of temporary loss). In addition, 3,308 acres of foraging habitat would be removed (2,652 acres of permanent loss, 656 acres of temporary loss). Activities that would impact suitable yellow-headed blackbird habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. The largest losses of foraging habitat would occur from loss of corn. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for water conveyance facilities. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow-headed blackbirds. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and CZ 8. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Site preparation and inundation from Environmental Commitment 4 would permanently remove or convert an estimated 21 acres of nesting habitat and 66 acres of foraging habitat.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of yellow-headed blackbird foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for yellow-headed blackbird but would not permanently reduce foraging habitat for the species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of yellow-headed blackbird foraging habitat. Resulting nontidal marsh creation could benefit yellow-headed blackbird by creating breeding habitat that also supports aquatic insects for foraging.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in

Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 5,626 acres (79 acres of nesting habitat and 5,547 acres of foraging habitat) of yellow-headed blackbird nesting habitat in the study area. These effects would result from the construction of the water conveyance facilities (58 acres of nesting habitat, 3,308 acres of foraging habitat), and implementing other Environmental Commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 8 Grassland Natural Community Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*, 21 acres of nesting habitat and 2,239 acres of foraging habitat).Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by water conveyance facilities would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 79 acres of nesting habitat should be restored/created and 79 acres should be protected to compensate for the water conveyance facilities losses of 79 acres of yellow-headed blackbird nesting habitat. In addition, 5,547 acres of foraging habitat should be protected to compensate for the losses of yellow-headed blackbird foraging habitat.

Project proponents would commit to creating or restoring 295 acres of tidal wetlands, creating 832 acres of nontidal wetlands, and protecting 119 acres of nontidal wetlands. These acres of restoration and protection would be more than sufficient to compensate for impacts on 79 acres of yellow-headed blackbird nesting habitat. Alternative 4A would also protect up to 1,060 acres of grassland

and 11,870 acres of cultivated lands, which would provide suitable foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

For the project to avoid adversely affecting individuals, preconstruction surveys for avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects**:** The loss of yellow-headed blackbird nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of yellow-headed blackbird habitat under Alternative 4A would not be adverse.

CEQA Conclusion**:** The effects on yellow-headed blackbird habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of Environmental Commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-headed blackbird. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on yellow-headed blackbird under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbirds. Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters, which reduce the potential for yellow-headed blackbird collision with transmission lines.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increased risk of predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increased risk of predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on yellow-headed blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increased risk of predation on yellow-headed blackbird from an increase in raptor perching opportunities would be minimal. The construction and operation of new transmission lines under Alternative 4A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of the Project on Yellow-Headed Blackbird

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see BDCP Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4, and EIR/EIS Appendix 11F, *Substantive BDCP Revisions*), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix 11F, *Substantive BDCP Revisions*. The review includes an overview of the project-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where the species habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect yellow-headed blackbird, via uptake in lower trophic levels (as described in BDCP Appendix 5.D, *Contaminants*).

Due to the complex and very site-specific factors that determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including yellow-headed blackbird. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and, therefore, increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations are analyzed in Chapter 8, *Water Quality*, which concludes that, relative to Existing Conditions and the No Action Alternative, construction and operation of proposed water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on yellow-headed blackbird from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the yellow-headed blackbird population would be expected to be minimal because the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

NEPA Effects**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the yellow-headed blackbird population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

CEQA Conclusion: In the absence of AMMs, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Tidal habitat restoration could result in increased exposure of yellow-headed blackbird to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the yellow-headed blackbird population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Indirect effects of Alternative 4A implementation would represent an adverse effect on yellow-headed blackbird in the absence of other Environmental Commitments. This would be a significant impact. With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of

Alternative 4A implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on yellow-headed blackbird.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Alternative 4A would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-4A-54. Alternative 4A would include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit the riparian brush rabbit.

- Increase the size and connectivity of the conservation area by acquiring lands adjacent to and between existing conservation lands (Resource Restoration and Performance Principle L1).
- Of the 103 acres of protected valley/foothill riparian natural community, protect and maintain 19 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Environmental Commitment 3 and Resource Restoration and Performance Principle RBR1).
- Of the 251 acres of restored valley/foothill riparian natural community, restore and maintain 19 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the

riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Environmental Commitment 7 and Resource Restoration and Performance Principle RBR2).

- Create and maintain high-water refugia in the 19 acres of restored riparian brush rabbit habitat and the 19 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Resource Restoration and Performance Principle RBR3).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Resource Restoration and Performance Principle RBR4).
- Of the 1,060 acres of grasslands protected, protect up to 227 acres of grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Resource Restoration and Performance Principle RBR5).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-54. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Riparian	14	3
	Grassland	164	68
Total Impacts Water Conveyance Facilities		**178**	**71**
Environmental Commitments 4, 6–7, 9–11[a]	Riparian	0	0
	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**178**	**71**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 4A would result in the permanent and temporary loss of up to 17 acres of riparian habitat and 232 acres of associated grassland habitat for the riparian brush rabbit in the study area (Table 12-4A-54). Environmental commitments that would result in these losses are conveyance facilities construction and geotechnical investigation. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Development of Alternative 4A water conveyance facilities would result in the permanent removal of approximately 14 acres of riparian habitat and 164 acres of associated grassland habitat and in the temporary removal of 3 acre of riparian habitat and 68 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-4A-54). There are no riparian brush rabbit occurrences in the water conveyance facilities construction footprint. The riparian habitat that would be removed is of low value for the riparian brush rabbit as it consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (see Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*, in the BDCP). Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of up to 227 acres of grassland and 19 acres of riparian habitat, as well as restoration of up to 19 acres of riparian habitat would benefit riparian brush rabbit (Table 12-4A-54). A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Enhancement and management actions in riparian brush rabbit habitat within the conservation area may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over time. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

- Operations and maintenance: Ongoing maintenance of project facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.

- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbit because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (see Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*, in the BDCP). Valley foothill/riparian natural communities restoration would not result in injury or mortality of the riparian brush rabbit because restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*).

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and AMMs that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are 6,012 acres of modeled riparian brush rabbit habitat in the study area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 4A would result in permanent and temporary effects combined on 17 acres of modeled riparian habitat (less than 1% of the habitat in the study area) and 232 acres of modeled grassland habitat (less than 1% of habitat in the study area) for riparian brush rabbit in CZ 6, CZ 7, and CZ 8.

These effects would result from the construction of the water conveyance facilities. The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the loss of riparian brush rabbit habitat would be in an area unlikely to be occupied by the species in CZ 8. Habitat loss in CZ 7, in areas known or likely to be occupied, would also occur. Riparian restoration would be phased to minimize temporal habitat loss. Alternative 4A includes a commitment to protect up to 464 acres of grassland and 17 acres of riparian habitat, and to restore up to 17 acres of riparian habitat for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The conserved habitat would also provide more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding.

The project would also protect grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees. These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. Grasslands on the landward side of levees adjacent to restored floodplain will be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit.

Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian and grassland areas that are occupied by riparian brush rabbit and controlled as needed (Environmental Commitment 11).

Typical NEPA and CEQA project-level mitigation ratios for loss of riparian and grassland habitats affected by water conveyance facilities would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 2:1 for protection of grassland for riparian brush rabbit. Using these ratios would indicate that 17 acres of riparian habitat should be restored, 17 acres of riparian habitat should protected, and 464 acres of grassland should be protected for riparian brush rabbit.

The project also contains commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM25 Riparian Woodrat and Riparian Brush Rabbit*. These AMMs contain elements that avoid or minimize the risk of project activities affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: The loss of riparian brush rabbit habitat and potential mortality under Alternative 4A would not be an adverse effect because there is little likelihood of riparian brush rabbits being present and because the project proponents have committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. This habitat protection, restoration, and enhancement would be guided by species-specific Resource Restoration and Performance Principles L1 and RBR1-RBR5, and by AMM1–AMM6, AMM10, and AMM25, which would be in place throughout the period of construction and operations. Considering these commitments, the effects of Alternative 4A as a whole on riparian brush rabbit would not be an adverse effect.

CEQA Conclusion: Considering Alternative 4A's commitment to the protection, restoration, and management of riparian brush rabbit habitat, Resource Restoration and Performance Principles L1 and RBR1-RBR5, and with the implementation of AMM1–AMM7, AMM10, and AMM25, the loss of habitat or direct mortality of riparian brush rabbit as a result of implementing Alternative 4A would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on riparian brush rabbit under CEQA.

Impact BIO-153: Indirect Effects of Alternative 4A on Riparian Brush Rabbit

Noise, lighting, and visual disturbances adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat in the study area. These construction activities would include water conveyance, geotechnical investigation, and restoration activities. Water conveyance facilities construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area; therefore, the potential for adverse noise, lighting, and visual effects from conveyance facility construction would be minimal. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of AMM1–AMM7, AMM10, and AMM25, as part of implementing Alternative 4A would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 4A would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from operations and maintenance as well as construction-related noise, lighting, visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, and AMM25 as part of Alternative 4A, the project would avoid and minimize the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 4A would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on riparian brush rabbit.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the study area in CZ 7, south of State Route 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; Williams 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47).

Alternative 4A would not result in losses of riparian woodrat modeled habitat as indicated in Table 12-4A-55. There is no modeled habitat for the species in either the water conveyance facilities or Environmental Commitment 4 (tidal restoration) footprint.

Table 12-4A-55. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11	0	0
TOTAL IMPACTS	**0**	**0**

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

No habitat would be lost or converted and there would be no direct mortality of riparian woodrat under Alternative 4A.

***NEPA Effects*:** No effect.

CEQA Conclusion: No Impact.

Impact BIO-156: Indirect Effects of Alternative 4A on Riparian Woodrat

There would be no indirect effects on riparian woodrat from Alternative 4A.

***NEPA Effects*:** No effect.

CEQA Conclusion: No Impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Alternative 4A

There would be no periodic inundation effects on riparian woodrat from Alternative 4A.

***NEPA Effects*:** No effect.

CEQA Conclusion: No Impact.

Salt Marsh Harvest Mouse

The habitat model used to assess effects for the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Alternative 4A would not result in effects on modeled salt marsh harvest mouse habitat as indicated Table 12-4A-56. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh, which is the extent of known salt marsh harvest mouse habitat in the study area.

Table 12-4A-56. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	0	0
TOTAL IMPACTS	**0**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

No habitat would be lost or converted and there would be no direct mortality of salt marsh harvest mouse under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Impact BIO-159: Indirect Effects of Alternative 4A on Salt Marsh Harvest Mouse

No indirect effects on salt marsh harvest mouse were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Suisun Shrew

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the Environmental Commitments, on the Suisun shrew. Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model.

Alternative 4A would not result in effects on modeled Suisun shrew habitat as indicated in Table 12-4A-57. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-57. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	0	0
TOTAL IMPACTS	**0**	**0**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun Shrew

No habitat would be lost or converted and there would be no direct mortality of Suisun shrew under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: No effect.

CEQA Conclusion: No Impact.

Impact BIO-161: Indirect Effects of Alternative 4A on Suisun Shrew

No indirect effects on Suisun shrew were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10. The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007a). CNDDB (California Department of Fish and Wildlife 2013) reports twelve occurrences of San Joaquin kit foxes along the extreme western edge of the project area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007b) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Alternative 4A would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-4A-58). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin San Joaquin kit fox habitat and potential American badger habitat. Alternative 4A would include the following Environmental Commitments and associated Resource Restoration and Performance Principles to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (see BDCP Chapter 3, *Conservation Strategy*). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the project area; and providing connectivity to habitat outside the project area.

- Protect and improve habitat linkages that allow native terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect up to 647 acres of grassland in the Byron Hills area where practicable and/or in other appropriate locations (Environmental Commitment 3 and Resource Restoration and Performance Principle G10).
- Protect up to 188 acres and restore up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitments 3 and 9, and Resource Restoration and Performance Principle VP/AW1).
- Increase burrow availability for burrow-dependent species in grasslands including grasslands surrounding restored and protected vernal pool and alkali seasonal wetland complexes (Resource Restoration and Performance Principle VP/AW6).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species in grasslands and within restored and protected vernal pool and alkali seasonal wetland complex (Resource Restoration and Performance Principle VP/AW7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-58. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Modeled Habitat	258	68
Total Impacts Water Conveyance Facilities		**258**	**68**
Environmental Commitments 4, 6–7, 9–11[a]	Modeled Habitat	4	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**262**	**68**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 4A conveyance facilities construction would result in the permanent and temporary loss combined of 330 acres of grassland habitat for the San Joaquin kit fox in the study area (Table 12-4A-58). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects are anticipated to be the same as those described for San Joaquin kit fox. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 258 acres and the temporary loss of 68 acres of modeled San Joaquin kit fox and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8. There are 3 San Joaquin kit fox and no American badger occurrences that overlap with the water conveyance facilities footprint.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of up to 647 acres of grassland would benefit San Joaquin kit fox and American badger individuals present in the area. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values. However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. *AMM24 San Joaquin Kit Fox* and Mitigation Measure BIO-162: *Conduct Preconstruction Survey for American Badger* would be implemented to ensure

that San Joaquin kit fox and American badger dens are avoided. AMM24 is described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*.

- Operations and maintenance: Ongoing maintenance of project facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, and AMM24 (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 330 acres of associated grassland habitat for San Joaquin kit fox and potential habitat for American badger, representing 6% of the modeled habitat. These effects would result from construction of the water conveyance facilities (326 acres) and natural communities enhancement and management activities (4 acres).

With full implementation of Alternative 4A, up to 647 acres of grassland would be protected in areas where the San Joaquin kit fox and American badger are most likely to occur in the study area. In addition, San Joaquin kit fox and American badger would benefit from the protection of up to 188 acres and restoration of up to 48 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills. Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see Appendix 2.A, *Covered Species Accounts*, of the BDCP), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the project area. Connectivity to occupied habitat adjacent to the project area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the project area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (see Appendix 2.A, *Covered Species Accounts*, of the BDCP). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range. These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The project's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

Typical NEPA and CEQA project-level mitigation ratio for the natural community that would be affected would be 2:1 for protection of grassland. Using this ratio would indicate that 660 acres of grassland should be protected for San Joaquin kit fox and American badger.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM24 San Joaquin Kit Fox.* These AMMs contain elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162, *Conduct Preconstruction Survey for American Badger*.

NEPA Effects: In the absence of the proposed Environmental Commitments, the effects on San Joaquin kit fox and American badger habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, VP/AW1, VP/AW6, VP/AW7, and G10 and guided by AMM1–AMM6, AMM10, and AMM24, which would be in place throughout the construction period and operations, and with implementation of Mitigation Measure BIO-162, the effects of Alternative 4A as a whole on San Joaquin kit fox and American badger would not be an adverse effect.

CEQA Conclusion: In the absence of the proposed Environmental Commitments, the effects on San Joaquin kit fox and American badger habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, VP/AW1, VP/AW6, VP/AW7, and G10, and guided by AMM1–AMM6, AMM10, and AMM24, which would be in place throughout the time period of construction and operations, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 4A as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, ground disturbance within project-related conservation areas within 50 feet of active American badger dens would be prohibited.Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on conservation areas with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability. Mitigation Measure BIO-162 is applicable to all ground-disturbing activities related to construction, restoration, and operations and maintenance.

Impact BIO-163: Indirect Effects of Alternative 4A on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facility, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, if any, and other measures as described in AMM1–AMM6, AMM10, AMM24, and Mitigation Measure BIO-162.

***NEPA Effects*:** Implementation of AMM1–AMM6, AMM10, and AMM24,and Mitigation Measure BIO-162 *Conduct Preconstruction Survey for American Badger*, would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on San Joaquin kit fox or American badger.

***CEQA Conclusion*:** Indirect effects from Environmental Commitment operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, and AMM24 as part of Alternative 4A construction, operation, and maintenance, the project would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species.

In addition, Mitigation Measure BIO-162 as described above, would further reduce of the potential for indirect effects of Alternative 4A on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

Habitat for San Joaquin pocket mouse consists of the grassland natural community throughout the study area. The species requires friable soils for burrowing. Alternative 4A would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-4A-59. Alternative 4A would also include the following Environmental Commitments and associated Resource Restoration and Performance Principles that would likely benefit San Joaquin pocket mouse.

- Protect up to 1,060 acres of grasslands (Environmental Commitment 3).
- Restore up to 1,070 acres of grasslands (Environmental Commitment 8).
- Sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (Resource Restoration and Performance Principle G3).

As explained below, with protection and management of this amounts of habitat, Alternative 4A's impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-59. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Grassland	467	158
Total Impacts Water Conveyance Facilities		**467**	**158**
Environmental Commitments 4, 6–7, 9–11[a]	Grassland	61	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**61**	**0**
TOTAL IMPACTS		**528**	**158**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 4A would result in the combined permanent and temporary loss of up to 686 acres of habitat for San Joaquin pocket mouse, of which 528 acres would be a permanent loss and 158 acres would be a temporary loss of habitat (Table 12-4A-59). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM areas, and *Environmental Commitment 4 Tidal Natural Communities Restoration*. The majority of habitat loss would result from water conveyance facilities. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 625 acres of potential San Joaquin pocket mouse habitat (467 acres of permanent loss, 158 acres of temporary loss) in CZ 3–CZ 6 and CZ 8. The majority of grassland that would be removed would be in CZ 8, from the modifications to Clifton Court Forebay. Refer to the Terrestrial Biology Mapbook for a detailed view of Alternative 4A construction locations. Construction of the forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Game 2012).
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Implementation would permanently inundate or remove an estimated 40 acres of potential San Joaquin pocket mouse habitat. The losses would occur in one or more of the ROAs established for tidal restoration (see Figure 12-1).
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of potential San Joaquin pocket mouse habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Environmental Commitment 7 would permanently remove an estimated 1 acre of potential San Joaquin pocket mouse habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* The protection of up to 1,060 acres of grassland for wildlife species is expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.
- A variety of habitat management actions included in *Environmental Commitment 11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. Alternative 4A enhancement and management actions designed for western burrowing owl would also be expected to benefit San Joaquin pocket mouse.

- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and environmental commitments as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other Environmental Commitments that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 686 acres of grasslands that could be suitable for San Joaquin pocket mouse (1% of the habitat in the study area). These effects would result from the construction of the water conveyance facilities. Alternative 4A includes a commitment to protect up to 1,060 acres of grassland (Environmental Commitment 3) and restore up to 1,070 acres of grassland (Environmental Commitment 8). Alternative 4A's commitment to sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes would protect a diversity of habitats that San Joaquin pocket mouse could use. All protected habitat would be managed under *Environmental Commitment 11 Natural Communities Enhancement and Management*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by the project would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,372 acres of grassland natural communities should be protected to mitigate the loss of 686 acres of grassland.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containments and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: In the absence of the Environmental Commitments, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 4A would represent an adverse effect. However, project proponents have committed to habitat protection and management associated with Environmental Commitment 3 and Environmental Commitment 11. This habitat protection and management would be guided by Resource Restoration and Performance Principle G3, and by AMM1–AMM6 and AMM10, which would be in place during construction. Considering these commitments, losses of San Joaquin pocket mouse and potential mortality under Alternative 4A would not be an adverse effect.

CEQA Conclusion: Considering Alternative 4A's commitment to the protection and management of grasslands and with the implementation of Resource Restoration and Performance Principle G3 and AMM1–AMM6 and AMM10, the loss of habitat or direct mortality through implementation of Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse under CEQA.

Impact BIO-165: Indirect Effects of Alternative 4A on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, Environmental Commitments, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat. These potential effects would be minimized and avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

NEPA Effects: Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on San Joaquin pocket mouse.

CEQA Conclusion: Indirect effects from Environmental Commitment operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6, and AMM10, as part of Alternative 4A construction, operation, and maintenance, Alternative 4A would avoid the potential for adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse under CEQA.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (see Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*, Table 12A-2). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, for details on methods and results, and Table 12A-2 in Appendix 12A). The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat. At the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. Biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-4A-60. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. Alternative 4A would include the following conservation and Resource Restoration and Performance Principles to benefit special-status bats.

- Protect up to 13,302 acres and restore up to 2,496 acres of high-value natural communities. This objective involves protecting and restoring a variety of habitat types described below that would also benefit special-status bats (see Table 3-9 in Chapter 3, *Description of Alternatives*).
- Protect up to 1,060 acres and restore up to 1,070 acres of grassland (Environmental Commitment 3 and Environmental Commitment 8).
- Restore grasslands to connect fragmented patches of protected grassland and to provide upland habitat (Resource Restoration and Performance Principal G1).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (Resource Restoration and Performance Principal G3).
- Increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (Resource Restoration and Performance Principal G4).
- Protect up to 11,870 acres of cultivated lands (Environmental Commitment 3).

- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principal CL1).
- Target cultivated land conservation to provide connectivity between other conservation lands wetlands (Resource Restoration and Performance Principal CL2).
- Restore up to 48 acres and protect up to 188 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).
- Protect up to 119 acres and restore up to 832 acres of nontidal marsh (Environmental Commitment 3 and Environmental Commitment 10).
- Protect up to 6 acres of ponds (Resource Restoration and Performance Principle G2).
- Restore up to 295 acres of tidal natural communities (Environmental Commitment 4).
- Restore up to 251 acres and protect up to 103 acres of valley/foothill riparian natural community (Environmental Commitment 3 and Environmental Commitment 7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-60. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting	64	200
	Foraging	4,496	3,459
Total Impacts Water Conveyance Facilities		**4,560**	**3,659**
Environmental Commitments 4, 6–7, 9–11[a]	Roosting	5	0
	Foraging	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**4,565**	**3,659**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 4A would result in the permanent and temporary loss combined of up to 264 acres of roosting habitat and 8,224 acres of foraging habitat for special-status bats from water conveyance facilities construction and from tidal restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could affect special-status bat roosting habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 64 acres of roosting habitat and 4,496 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 200 acres of roosting habitat and up to 3,459 acres of foraging habitat for special-status bats in the study area (Table 12-4A-60). DWR identified two bridges with potential night roosting habitat in the forebay embankment area and tunnel muck area that could be permanently affected by construction for water conveyance facilities. Additional roosting habitat affected by construction and operations includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the loss of approximately 5 acres of roosting habitat. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, requires that tidal natural communities restoration avoid effects on roosting special-status bats.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Implementation of Alternative 4A would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.
- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.
- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to the Environmental Commitments could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A activities that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat resulting from water conveyance facilities and Environmental Commitment 4.

Alternative 4A would permanently or temporarily affect 269 acres of roosting habitat for special-status bats as a result of implementing water conveyance facilities (264 acres roosting habitat) and Environmental Commitment 4 (5 acres roosting habitat). Only 72 acres of the 269 acres of roosting habitat losses would be in valley/foothill riparian habitat Alternative 4A would restore up to 251 acres and protect up to 103 acres of valley/foothill riparian roosting habitat and 15,798 acres of additional foraging habitat in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Implementation of Alternative 4A would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 15,798 acres of their foraging and roosting habitats. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale. Achieving this is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Environmental commitments would sufficiently offset the adverse effects resulting from effects from water conveyance facilities and Environmental Commitment 4.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 72 acres of riparian habitat should be restored and 72 acres of riparian habitat should be protected.

The project also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils,* and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. BDCP

Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EISS.

***NEPA Effects*:** The losses of roosting and foraging habitat for special-status bats associated with implementing Alternative 4A are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the project proponents have committed to protecting the acreage required to meet the typical mitigation ratios described above. The losses of roosting and foraging habitat for special-status bats, in the absence of the Environmental Commitments, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the Environmental Commitments and Resource Restoration and Performance Principles, the implementation of AMM1–AMM6, and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 4A as a whole on special-status bats would not be adverse.

***CEQA Conclusion*:** The permanent loss of roosting habitat from Alternative 4A would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The project also contains commitments to implement habitat protection and restoration associated with the Environmental Commitments and Resource Restoration and Performance Principles,and AMM1–6 and AMM10, which would offset the loss of foraging habitat. These AMMs include elements that avoid or minimize the risk of project activities affecting habitat and species adjacent to work areas and storage sites. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.

- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined by DWR in consultation with CDFW and shall include, as applicable, the measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.
- Disturbance of the bridge will be avoided between March 1 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bat species that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal will be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 31, later tree removal may be considered in consultation with CDFW.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent feasible and an appropriate buffer established in consultation with CDFW. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction would be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:

- Eviction will not occur before September 15th and will match the timeframe for tree removal approved by CDFW.
- Qualified biologists will carry out or oversee the eviction tasks and monitor the tree trimming/removal.
- Eviction will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
- Eviction will take place during weather and temperature conditions conducive to bat activity.
- Special-status bat roosts would not be disturbed.

Eviction procedures shall include but are not limited to:

- Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.
- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Noninjurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation at a 1:1 ratio for the loss of roosting habitat would be accomplished by the restoration of up to 251 acres and protection of up to 103 acres of valley/foothill riparian habitat. Compensation may include the construction and installation of suitable replacement roosting habitat onsite as described below. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, “bat bark,” planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. “Bat bark” has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Alternative 4A on Special-Status Bats

Construction activities associated with water conveyance facilities, restoration activities, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic disturbances from light, vibrations, and noise with localized effects on special-status bats and their roosting habitat.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural communities restoration would potentially indirectly affect special-status bat species. *Environmental Commitment 12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *Environmental Commitment 12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from tidal natural communities restoration.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure and *Environmental Commitment 12 Methylmercury Management* would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on special-status bats.

***CEQA Conclusion*:** Indirect effects from Environmental Commitments, operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, and *Environmental Commitment 12 Methylmercury Management* would reduce this impact to a less-than-significant level by reducing the likelihood for impacts to occur to roosting bats and would ensure Alternative 4A would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects of inundation on special-status bats or their habitat.

***NEPA Effects*:** No effects.

***CEQA Conclusion*:** No impacts.

Plant Species

Vernal Pool Species

Seventeen special-status plant species occur in vernal pools in the study area (Tables 12-2 and 12-3, summarized in Table 12-4A-61). The vernal pool habitat model used for the impact analysis on vernal pool species was developed for the BDCP and was based on vegetation types and associations from various data sets. The model was used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which these species are known to occur, including vernal pool complex, degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 4A.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principle VPS1 would include the following conservation commitment to benefit special-status vernal pool plant species

- Protect at least two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Resource Restoration and Performance Principle VPS1).

The construction activities proposed under Alternative 4A could have impacts on special-status vernal pool plant species. Modeled habitat is within the proposed footprint for the Alternative 4A water conveyance facilities. One known occurrence of a special-status plant species is within the proposed footprint for the Alternative 4A water conveyance facilities. Table 12-4A-61 summarizes the acreage of modeled vernal pool habitat in the study area and the number of occurrences of each special-status vernal pool species in the study area.

1 **Table 12-4A-61. Summary of Impacts on Vernal Pool Plant Species under Alternative 4A**

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Vernal pool complex	9,557	29	–	–	Potential habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Degraded vernal pool complex	2,576	17	–	–	Potential habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Alkali Seasonal Wetland	188	2	–	–	Potential habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Total	12,321	49	–	–	Potential habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Species					
Alkali milk-vetch	–	–	16	1	Population loss from construction of the water conveyance facilities
Dwarf downingia	–	–	12	0	None
Boggs Lake hedge-hyssop	–	–	1	0	None
Legenere	–	–	8	0	None
Heckard's peppergrass	–	–	4[a]	0	None
Ferris' milk-vetch	–	–	6	0	None
Vernal pool smallscale	–	–	2	0	None
Hogwallow starfish	–	–	0	0	None
Ferris' goldfields	–	–	4	0	None
Contra Costa goldfields	–	–	7	0	None
Cotula-leaf navarretia	–	–	5	0	None
Baker's navarretia	–	–	3	0	None
Colusa grass	–	–	1	0	None
Bearded popcorn-flower	–	–	4	0	None
Delta woolly marbles	–	–	3	0	None
Saline clover	–	–	9	0	None
Solano grass	–	–	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

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Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Under Alternative 4A, construction of the water conveyance facilities would affect habitat for special-status vernal pool species and one occurrence of a special-status vernal pool species.

- *Water Facilities and Operations*: Twenty-three acres of modeled vernal pool habitat, 19.4 acres of critical habitat for Contra Costa goldfields, and one known occurrence of the 17 vernal pool species are within the proposed footprint for the Alternative 4A water conveyance facilities. One occurrence of alkali milk-vetch in CZ 8 would be crossed by an electric transmission line. Under Alternative 4A, construction and operation of the water conveyance facilities could affect undiscovered occurrences of the seventeen special-status plant species.
- The east-west transmission line would not affect four special-status vernal pool species that occur in the study area. One occurrence each of dwarf downingia, legenere, Heckard's peppergrass, and Boggs Lake hedge-hyssop are within the east-west transmission line study area. However, the transmission line would not cross any of the occurrences.
- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A proposes to benefit special-status vernal pool plants by protecting 188 acres of vernal pool complex and alkali seasonal wetland complex. The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration is estimated to result in the inundation of 26 acres of modeled habitat for vernal pool species and could, therefore, potentially affect special-status vernal pool plants. However, under this Environmental Commitment, no tidal habitat restoration would be implemented in habitat for special-status plant species. No known occurrences of special-status vernal pool species would be affected by tidal restoration.
- *Environmental Commitment 6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plant species are present within the general areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status vernal pool species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plant species are present within the general areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status vernal pool species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, construction of the water conveyance facilities results in the net loss of vernal pool habitat, environmental commitments would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plant species would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool species or affect vernal pool habitat adjacent to the restoration areas.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on special-status vernal pool plant species.

- *Avoidance and Minimization Measures*: Effects on special-status vernal pool plant species potentially resulting from implementation of Alternative 4A would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM12 Vernal Pool Crustaceans, and AMM30 Transmission Line Design and Alignment Guidelines.* AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres. AMM12 also requires that that tidal natural communities restoration or other ground-disturbing project activities in Conservation Zones 1 and 11 not result in the adverse modification of primary constituent elements of critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM30 specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In addition, Environmental Commitment 3 includes Resource Restoration and Performance Principle VPS1 to protect two occurrences of alkali milk-vetch.

In summary, no adverse effects on special-status vernal pool plants would be expected from implementing Alternative 4A. Construction of the water conveyance facilities could affect one species, alkali milk-vetch, although adverse effects on this species would be avoided or minimized though implementation of AMM11 and AMM30. No other known occurrences of special-status vernal pool species would be affected under Alternative 4A. Beneficial effects on special-status vernal pool plants could occur by protecting 188 acres of vernal pool complex and by protecting occurrences of alkali milk-vetch.

The GIS analysis estimated that up to 49 acres of vernal pool habitat could be adversely affected by proposed activities. Under *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration,* up to 49 acres of vernal habitat would be restored to compensate for the loss. However, the actual effect on habitat for special-status vernal pool plant species is expected to be much less than the estimated impact because Alternative 4A limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 49 and 73.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants. This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts.

NEPA Effects: The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through the environmental commitments, and effects of constructing the water conveyance facilities on one occurrence of alkali milk-vetch would be avoided through AMM30. Therefore, Alternative 4A would not result in adverse effects on federally listed vernal pool plant species.

CEQA Conclusion: Because loss of modeled habitat for vernal pool plant species would be offset through restoration, and because impacts on occurrences of special-status vernal pool plant species would be avoided, implementation of Alternative 4A would not result in a reduction in the range or numbers of 17 special-status vernal pool plant species in the study area. Therefore, impacts on special-status vernal pool plant species would be less than significant. No mitigation is required.

Alkali Seasonal Wetland Species

Eight special-status plant species occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-62). Alkali seasonal wetland habitat was modeled separately for four plant species occurring in seasonal alkali wetlands. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the four alkali seasonal wetland species not proposed for coverage under the BDCP.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border of the study area. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principle ASWS1 would include Environmental Commitments to benefit special-status alkali seasonal wetland species.

- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Resource Restoration and Performance Principle ASWS1).

Modeled habitat for Delta button-celery would be adversely affected by construction of the Alternative 4A water conveyance facilities. One population of crownscale also would be adversely affected by construction of the water conveyance facilities. No adverse effects on palmate-bracted bird's-beak or recurved larkspur would be expected. Table 12-4A-62 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland plant species in the study area.

Table 12-4A-62. Summary of Impacts on Seasonal Alkali Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	96	–	–	Potential habitat loss from construction of water conveyance facilities and tidal wetlands restoration
Brittlescale modeled habitat	451	1	–	–	Potential habitat loss from tidal wetlands restoration
Heartscale modeled habitat	6,528	14	–	–	Potential habitat loss from tidal wetlands restoration
Delta button-celery modeled habitat	3,361[a]	97	–	–	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	2	–	–	Potential habitat loss from construction of water conveyance facilities and tidal wetlands restoration
Species					
San Joaquin spearscale	–	–	19	1	Population loss from construction of water conveyance facilities
Brittlescale	–	–	8	0	None
Heartscale	–	–	3	0	None
Delta button-celery	–	–	1[b]	0	None
Heckard's peppergrass	–	–	1[c]	0	
Crownscale	–	–	17	1	Population loss from construction of water conveyance facilities
Palmate-bracted bird's-beak	–	–	1	0	None
Recurved larkspur	–	–	4	0	None

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Alternative 4A would have potential adverse effects on modeled habitat for San Joaquin spearscale, brittlescale, heartscale, and Delta button-celery. It would also have adverse effects on occurrences of San Joaquin spearscale and crownscale. Under Alternative 4A, construction of the Clifton Court Forebay would permanently remove 75 acres of modeled habitat for San Joaquin spearscale and 97 acres of modeled habitat for Delta button-celery. This could be an adverse effect, depending on whether or not the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. One known occurrence of San Joaquin spearscale near the forebay would be affected by facilities construction. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected. Construction of the water conveyance facilities would permanently remove about 1.5 acre of habitat occupied by crownscale at the Clifton Court Forebay. All or most of the occurrence would be directly affected. Construction of the water conveyance facilities would not affect brittlescale, heartscale, Heckard's peppergrass, palmate-bracted bird's-beak, or recurved larkspur.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would benefit alkali seasonal wetland plants by including alkali seasonal wetland in the 188 acres of vernal pool complex habitat that would be protected and 48 that would be restored. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration is estimated to result in the inundation of modeled habitat for brittlescale (1 acre), heartscale (14 acres), and San Joaquin spearscale (21 acres), potentially affect special-status vernal pool plants. However, under this Environmental Commitment, no tidal habitat restoration would be implemented in habitat for special-status plant species. Therefore, tidal habitat restoration would not affect special-status alkali seasonal wetland species.
- *Environmental Commitment 6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within the general areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status alkali seasonal wetland species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within the general areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status alkali seasonal wetland species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on special-status alkali seasonal wetland plants. In addition, the Environmental Commitments would compensate for the loss of alkali seasonal wetlands resulting from other Environmental Commitments by restoring vernal pool complex that includes alkali seasonal wetlands to achieve no net loss of this habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on special-status alkali seasonal wetland plant species.

Avoidance and Minimization Measures: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of the water conveyance facilities would be avoided or minimized through *AMM2 Construction Best Management Practices and Monitoring, AMM11 Covered Plant Species,* and *AMM30 Transmission Line Design and Alignment Guidelines*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of special-status species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM30 requires that transmission line construction avoid any losses of alkali seasonal wetland complex natural community. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, only one known occurrence of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 4A. AMM11 would be implemented to avoid an adverse effect on the San Joaquin spearscale occurrence.

The primary effect of Alternative 4A on special-status alkali seasonal wetland plant species would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale and Delta button-celery. Approximately 1 acre of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland species is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the total loss of wetted vernal pool habitat is limited to 10 acres (approximately 67 acres of vernal pool complex) (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex. Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis. These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

Alternative 4A would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting a small amount of alkali seasonal wetland habitat. The environmental commitments also include protecting 2 occurrences of San Joaquin spearscale.

NEPA Effects: Under Alternative 4A, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (Environmental Commitment 8, Environmental Commitment 9), and impacts on one occurrence of San Joaquin spearscale would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse. The loss of one occurrence of crownscale, a non-listed species, would result in a reduction in the range and numbers of this species and would be an adverse effect. Adverse effects on crownscale could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of special-status alkali seasonal wetland species would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 4A would not result in substantially reducing the number or restricting the range of seven special-status alkali seasonal wetland plant species. However, Environmental Commitments that benefit or protect listed species do not apply to nonlisted species, and loss of the crownscale population at Clifton Court Forebay would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plant species, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on diamond-petaled California poppyand caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified plant species if feasible. The purpose of these surveys will be to verify that the locations of special-status species identified in previous record searches or surveys are extant, identify any new special-status plant species occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plant species will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plant species in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of special-status fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided if feasable through the establishment of 250-foot activity exclusion zones surrounding the periphery of the occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be according to a 250-foot buffer surrounding the periphery of each special-status plant species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occurrence periphery. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.
- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (preservation: impact). DWR will provide detailed

information to USFWS and CDFW on the location of the preserved occurrences, quality of the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Grassland Species

Twelve special-status plant species occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-63). The only modeled plant species occurring in grassland is Carquinez goldenbush. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the six grassland species not proposed for coverage under the BDCP.

Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extent of alluvium deposits in close proximity to the actual rivers/streams.

Of 78,047 acres of grasslands in the study area, Alternative 4A would adversely affect 678 acres under Alternative 4A. No known occurrences of special-status grassland plant species would be affected. Table 12-4A-63 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland species in the study area.

Table 12-4A-63. Summary of Impacts on Grassland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	1	–	–	Potential habitat loss from tidal wetland restoration
Grassland	78,047	678	–	–	Habitat loss from construction of water conveyance facilities and tidal wetland restoration
Species					
Carquinez goldenbush	–	–	10	0	None
Big tarplant	–	–	5	0	None
Round-leaved filaree	–	–	2	0	None
Pappose tarplant	–	–	7	0	None
Parry's rough tarplant	–	–	5	0	None
Small-flowered morning-glory	–	–	0	0	None
Diamond-petaled poppy	–	–	1	0	None
Stinkbells	–	–	1	0	None
Fragrant fritillary	–	–	4	0	None
Gairdner's yampah	–	–	0	0	None
Streamside daisy[a]	–	–	1	0	None
Caper-fruited tropidocarpum	–	–	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified for analysis of Alternative 4A.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plants

Alternative 4A would have no expected effects on known occurrences of special-status plant species that occur in grasslands. However, the loss of 678 acres of grassland would have the potential to affect undocumented populations of special-status grassland species.

No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland plant species are within the proposed footprint for the Alternative 4A water conveyance facilities. About 647 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 4A, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would preserve 1,060 acres of grassland habitat. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration is estimated to result in the loss of 26 acres of grassland habitat, including 1 acre of modeled

habitat for Carquinez goldenbush. However, under this environmental commitment, no tidal habitat restoration would be implemented in habitat for special-status plant species. No other occurrences of special-status grassland plants are within portions of the study area potentially suitable for tidal restoration. Therefore, tidal restoration would have no impacts on known occurrences of special-status grassland plants.

- *Environmental Commitment 6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within the general areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on special-status grassland plants.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within the general areas (along levees and in cultivated lands) proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status grassland plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plant species would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on special-status grassland plant species.
- *Avoidance and Minimization Measures*: Potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species,* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized through AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

NEPA Effects: Implementation of Alternative 4A would result in no adverse effects on federally listed grassland plant species.

CEQA Conclusion: Alternative 4A would have no impacts on special-status grassland species. No mitigation is required.

Valley/Foothill Riparian Species

Four special-status plant species occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-64). Habitat modeling was done for two species, Delta button celery and slough thistle. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the two valley/foothill species not proposed for coverage under the BDCP.

The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 4A would affect73 acres, none of which is modeled habitat for Delta button-celery and slough thistle. Table 12-4A-64 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status riparian species in the study area.

Table 12-4A-64. Summary of Impacts on Valley/Foothill Riparian Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button-celery modeled habitat	3,361[a]	0	–	–	None
Slough thistle modeled habitat	1,834	0	–	–	None
Valley/foothill riparian habitat	17,966	73	–	–	Habitat loss from construction of water conveyance facilities
Species					
Delta button-celery	–	–	1[b]	0	None
Slough thistle	–	–	2	0	None
Northern California black walnut	–	–	1	0	None
Wright's trichocoronis	–	–	1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland.
[b] A second occurrence is in alkali seasonal wetland.

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plant species are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would not be affected by construction of the water conveyance facilities.

Construction of the water conveyance facilities would remove 73 acres of valley-foothill riparian habitat under Alternative 4A. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian species are within the proposed footprint for the Alternative 4A water conveyance facilities. Therefore, under Alternative 4A, construction and operation of the water conveyance facilities would not affect special-status valley/foothill riparian species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would protect up to 103 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate an estimated 5 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the portions of the study area potentially suitable for tidal restoration. Therefore, tidal restoration would not affect the special-status valley/foothill riparian plants.
- *Environmental Commitment 6 Channel Margin Habitat Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within the general areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status valley/foothill riparian plant species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plant species are present within the general areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status valley/foothill riparian plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plant species are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status valley/foothill riparian species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on special-status valley/foothill riparian plant species.
- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though AMM2. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 4A is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for special-status plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 4A would not have an adverse effect on these species.

NEPA Effects: Implementation of Alternative 4A would not have an adverse effect on federally listed valley/foothill riparian plant species.

CEQA Conclusion: Alternative 4A would have no impact on special-status valley/foothill riparian plant species. No mitigation is required.

Tidal Wetland Species

Eight special-status plant species occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-65). Five tidal wetland habitat models were developed for special-status plant species occurring in tidal wetland habitat. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the Bolander's water hemlock, which was not proposed for coverage under the BDCP.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitats cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principles TWS1 and TWS2 would include the following Environmental Commitments to minimize impacts on tidal wetland species.

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites (Resource Restoration and Performance Principle TWS1).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Resource Restoration and Performance Principle TWS2).

Of 17,357 acres of tidal wetlands in the study area, Alternative 4A would affect 11 acres of tidal freshwater emergent wetland including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, and Suisun Marsh aster. Known occurrences Mason's lilaeopsis, side-flowering skullcap, and Suisun Marsh aster would be affected. Table 12-4A-65 summarizes the acreage of modeled habitat for special-status tidal wetland species and the number of occurrences of each special-status tidal wetland plant species in the study area.

Table 12-4A-65. Summary of Impacts on Tidal Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/ Mason's lilaeopsis modeled habitat	6,081	37	–	–	Potential habitat loss from construction of water conveyance facilities
Side-flowering skullcap modeled habitat	2,497	7	–	–	Potential habitat loss from construction of water conveyance facilities
Soft bird's-beak modeled habitat	1,228	0	–	–	None
Delta tule pea/Suisun Marsh aster modeled habitat	5,853	2	–	–	Potential habitat loss from construction of water conveyance facilities
Suisun thistle modeled habitat	1,281	0	–	–	None
Tidal brackish emergent wetland	8,501	0	–	–	None
Tidal freshwater emergent wetland	8,856	11	–	–	Habitat loss from construction of water conveyance facilities
Species					
Delta mudwort	–	–	58	0	None
Delta tule pea	–	–	106	0	
Mason's lilaeopsis	–	–	181	8	Occurrences affected by construction of water conveyance facilities
Side-flowering skullcap	–	–	12	1	Occurrence affected by construction of water conveyance facilities
Soft bird's-beak	–	–	13	0	None
Suisun Marsh aster	–	–	164	3	Occurrences affected by construction of water conveyance facilities
Suisun thistle	–	–	4	0	None
Bolander's water hemlock	–	–	8	0	None

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 4A would have adverse effects on tidal marsh special-status plant species.

The individual effects of each relevant Environmental Commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

Water Facilities and Operations: Construction of the Alternative 4A water conveyance facilities would remove 37 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 7 acres of modeled habitat for side-flowering skullcap, and 2 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, eight occurrences of Mason's lilaeopsis, three occurrences of Suisun Marsh aster, and one occurrence of side-flowering skullcap in the study area could be affected by construction impacts. No known occurrences of the other special-status tidal wetland species would be affected by construction of the water conveyance facilities.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A does not specifically propose to protect any habitat or occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: As stated in this Environmental Commitment, no tidal habitat restoration would be implemented in habitat for special-status plant species. Therefore, tidal habitat restoration would not affect modeled habitat for Mason's lilaeopsis and Delta mudwort or any occurrences of tidal wetland special-status plant species.
- *Environmental Commitment 6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed. Channel margin enhancement could have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would compensate for effects on these species by improving the habitat functions of the channel margins as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of Environmental Commitment 4. Riparian plantings carried out for Environmental Commitment 7 would be placed in floodplain areas, not in tidal wetlands.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status tidal wetland plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plant species are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status tidal wetland plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on special-status tidal wetland plant species.

Avoidance and Minimization Measures: Effects on special-status tidal wetland plant species potentially resulting from construction of the water conveyance facilities would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring,* and *AMM30 Transmission Line Design and Alignment Guidelines*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though AMM2. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis and side-flowering skullcap. BDCP Appendix 3.C describes the AMMs, which have since been updated and which are provided in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, of the Final EIR/EIS.

In summary, the GIS analysis indicates that Alternative 4A would result in the loss of modeled habitat for five special-status species and result in adverse effects on known occurrences of three of the special-status species occurring in tidal wetlands.

Delta mudwort could lose 37 acres of modeled habitat, but no known occurrences would be affected. Channel margin enhancement (Environmental Commitment 6) and riparian natural community restoration (Environmental Commitment 7) will consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, natural expansion of populations into the restored habitat may take place

Mason's lilaeopsis could lose 37 acres of modeled habitat), including all or part of eight occurrences. Tidal habitat restoration activities (Environmental Commitment 4) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Although active restoration of this species is not proposed, the natural expansion of populations into the restored habitat may take place. The Environmental Commitments include post-implementation monitoring of affected occurrences and occurrences in conservation areas to confirm that no net loss of occurrences has been achieved.

Both of these species (Delta mudwort, Mason's lilaeopsis) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected, it is likely that the initial adverse effects of construction activities on these species would be offset and that the overall effect of Alternative 4A on these species would not be adverse.

Side-flowering skullcap could lose one occurrence. Under AMM11, this occurrence would be surveyed for, and because this is a tidal freshwater wetland species, avoidance of the habitat during project construction would be highly likely. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in conservation areas would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, the overall effect of Alternative 4A on this species would not be adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (Environmental Commitment 4). Therefore, implementation of Alternative 4A would result in no adverse effects on eight special-status tidal wetland plant species in the study area.

CEQA Conclusion: Because loss of occurrences and modeled habitat for special-status tidal habitat plant species would be offset through habitat restoration, impacts on special-status tidal wetland plants as a result of implementing Alternative 4A would not be significant.

Inland Dune Species

Five special-status plant species occur in inland dune habitat in the study area. No habitat models were prepared for inland dune habitat. Table 12-4A-66 summarizes the acreage of inland dune habitat in the study area and the number of occurrences for each special-status inland dune species in the study area.

Table 12-4A-66. Summary of Impacts on Inland Dune Plants under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Inland Dunes	19	0	–	–	None
Species					
Hoover's cryptantha	–	–	1	0	None
Antioch Dunes buckwheat	–	–	1	0	None
Mt. Diablo buckwheat	–	–	1	0	None
Contra Costa wallflower	–	–	3	0	None
Antioch Dunes evening-primrose	–	–	9	0	None

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 4A would have no adverse effects on inland dune species (Table 12-4A-66). No construction activities would take place where the species occur. No specific actions to benefit inland dune species are proposed.

NEPA Effects: Implementation of Alternative 4A would not affect special-status inland dune species.

CEQA Conclusion: Implementation of Alternative 4A would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Species

Six special-status plant species occur in nontidal wetlands in the study area. Table 12-4A-67 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland species in the study area.

Table 12-4A-67. Summary of Impacts on Nontidal Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	2,339	–	–	Loss or disturbance of habitat from construction of water conveyance facilities and tidal habitat restoration
Nontidal freshwater perennial emergent wetland	1,509	6	–	–	Loss or disturbance of habitat from construction of water conveyance facilities and tidal habitat restoration
Species					
Watershield	–	–	3	1	Loss of habitat from construction of water conveyance facilities
Bristly sedge	–	–	18	3	Loss of occurrences from construction of water conveyance facilities
Woolly rose-mallow[a]	–	–	121	14	Loss of occurrences from construction of water conveyance facilities
Eel grass pondweed	–	–	1	0	None
Sanford's arrowhead	–	–	23	1	Loss of occurrences from construction of water conveyance facilities
Marsh skullcap[a]	–	–	1	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 4A, known occurrences watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead would be within the proposed footprint for the water conveyance facilities and could be adversely affected. Alternative 4A would have no adverse effects on eel-grass pondweed or marsh skullcap.

Construction of the Alternative 4A water conveyance facilities would adversely affect four special-status plant species occurring in nontidal wetlands. One of three watershield occurrences in CZ 5 on Bouldin Island could be affected by construction of the water conveyance facilities. This is a historical occurrence that has not been observed since 1893, and it may be extirpated (California Department of Fish and Wildlife 2013). Three occurrences of bristly sedge in CZ 4 and CZ 5, including approximately 1.54 acres of occupied habitat, would be affected by construction of the water conveyance facilities. Fourteen occurrences of woolly rose-mallow would be affected. Six occurrences in CZ 4 could be removed during construction of the intake facilities and disposal of RTM, and four occurrences in CZ 6 and four occurrences in CZ 8 could be affected by construction of other facilities and by geotechnical investigations. Construction of the water conveyance facilities could remove occupied habitat at one occurrence of Sanford's arrowhead in CZ 4. Under Alternative

4A, construction and operation of the water conveyance facilities could affect 77 acres of nontidal wetlands, which could have adverse effects on undiscovered occurrences of the six special-status nontidal wetland plant species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under Alternative 4A. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: No habitat or known occurrences of special-status nontidal wetland plants are present within the general areas proposed for tidal habitat restoration. Therefore, tidal habitat restoration would have no adverse effects on special-status nontidal wetland plants.
- *Environmental Commitment 6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plant species are present within the general areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on known occurrences of special-status nontidal wetland species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plant species are present within the general areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on known occurrences of special-status nontidal wetland species.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plant species are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status nontidal wetland plants.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. Alternative 4A may benefit nontidal wetland species by creating 832 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for special-status and other native species. However, no specific actions to benefit special-status species are proposed.

Under Alternative 4A, 119 acres of nontidal marsh would be restored. However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, and potential loss of habitat or occurrences resulting from construction activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not addressed by Environmental Commitments, the species protections afforded to listed species under the AMMs do not apply to these species, and the effects of Alternative 4A on these species would be adverse. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species*, would reduce these effects.

NEPA Effects: Implementation of Alternative 4A could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, four nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Under Alternative 4A, construction of the water conveyance facilities could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead. These impacts would be significant. Implementation of Mitigation Measure BIO-170 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

General Terrestrial Biology

Wetlands and Other Waters of the United States

Alternative 4A actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The 404 regulations and relevant information on mitigating the effects of impact on wetlands and other waters of the United States are described in Section 12.2.1.1. The methods used to conduct these analyses are described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*. Waters of the United States data used for this analysis is based on a verified wetland delineation from the USACE that was completed in early 2015. The waters of the United States were mapped at a finer scale than that which was done for the natural community mapping for the BDCP and therefore the acreages of these two datasets differ when compared to each other. The waters of the United States mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities on Wetlands and Other Waters of the United States

Alternative 4A proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the United States. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-4A-68 below. Based on the methodology used to conduct this analysis, the losses would occur at intake, tunnel, pipeline, canal, and RTM and borrow/spoil storage sites, transmission corridors, and multiple temporary work areas associated with the construction activity. The permanent waters of the United States losses would occur at various locations along the modified pipeline/tunnel alignment. The majority of the loss would result from the expansion of Clifton Court Forebay, new transmission lines, construction of Alternative 4A's three intake structures along the eastern bank of the Sacramento River between Clarksburg and Courtland in the north Delta, and at the RTM storage sites associated with tunnel construction at various locations between Lambert Road and Twin Cities Road, on Bouldin Island, and on Byron Tract, adjacent to Clifton Court Forebay.

The temporary effects on waters of the United States would also occur mainly at the three intake construction sites along the eastern bank of the Sacramento River, and at barge unloading facilities in the San Joaquin River, Snodgrass Slough, Potato Slough, Connection Slough, Old River, and West Canal. An additional temporary effect would result from dredging of Clifton Court Forebay.

Table 12-4A-68. Estimated Fill of Waters of the United States Associated with the Construction of Water Conveyance Facilities under Alternative 4A

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]
Agricultural Ditch	42.2	13.2	0	55.4
Alkaline Wetland	10.4	0.1	0	10.5
Clifton Court Forebay	257.9	0	1,930.6	257.9
Conveyance Channel	7.1	2.9	0	10.0
Depression	29.3	6.2	0	35.5
Emergent Wetland	56.8	14.7	0	71.5
Forest	7.2	5.2	0	12.4
Lake	23.2	0	0	23.2
Scrub-Shrub	12.7	3.7	0	16.3
Seasonal Wetland	114.5	10.0	0	124.5
Tidal Channel	15.3	65.6	0	80.8
Vernal Pool	0.3	0	0	0.3
Total	**577**	**121**	**1,931**	**698**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

[b] Temporary impacts are due to dredging Clifton Court Forebay.

[c] Total does not include temporary impacts on Clifton Court Forebay because these would just be temporary disturbance to open water, which typically do not require compensatory mitigation.

The majority of the impacts on wetlands and waters of United States would be on wetlands found within cultivated lands (mostly agricultural ditches and seasonal wetlands) and waters associated with Clifton Court Forebay. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States*, all occur in the central Delta within plowed agricultural fields and would be mostly affected by the RTM storage sites and transmission line construction. The effects on Clifton Court Forebay would primarily result from the establishment of new embankments around and across the existing forebay. The forebay would be expanded to the south by an additional 450 acres of storage space resulting in a net gain of open water in the forebay.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the Clean Water Act permitting process. The results of this assessment will be compared to the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands will be significantly less than high function, the compensatory mitigation will result in a net increase in wetland function.

The proposed project was designed to avoid waters of the United States to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, AMM2 and AMM6 would be implemented, as described in the AMMs set out in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, to further avoid and minimize effects on waters of the United States as well as on special-status species. The AMMs would be implemented during all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the United States are *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans*, *AMM30 Transmission Line Design and Alignment Guidelines*, *AMM34 Construction Site Security*, and *AMM36 Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, will also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing Environmental Commitment 4–Environmental Commitment 10 described for Alternative 4A, some of which could serve the dual purpose of offsetting effects to species and mitigating impacts on waters of the United States, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 4A pursuant to USACE's and U.S. EPA's Mitigation Rule (see Section 12.2.1.1). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States* would be available to address adverse impacts on waters of the United States.

NEPA Effects: The permanent and temporary loss of wetlands and waters of the United States as a result of constructing Alternative 4A water conveyance facilities would be a substantial effect if not compensated by wetland restoration and protection. This loss would represent a fill of water of the U.S. as defined by Section 404 of the CWA. The project proponents would implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects on wetlands and waters. However, specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the United States and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce these effects such that they are not adverse.

CEQA Conclusion: The permanent and temporary loss of wetlands and waters of the United States as a result of constructing Alternative 4A water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level. Additionally, Alternative 4A would restore up to 1,134 acres of wetlands as part of the proposed project, which would include 295 acres of tidal marsh restoration (Environmental Commitment 4), 7 acres of vernal pool/alkali seasonal wetlands (Environmental Commitment 9; 48 acres of vernal pool complex assuming a wetland density of 15%), and 832 acres of nontidal marsh restoration (Environmental Commitment 10). In addition, Alternative 4A would restore up to 251 acres of riparian habitat (Environmental Commitment 7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 4.6 miles of levees will have channel margin enhancement conducted on them (Environmental Commitment 6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees.

The success in implementing these Environmental Commitments would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the BDCP for tidal marsh restoration (BDCP Chapter 3, *Conservation Strategy*, Section 3.4.4.4), channel margin enhancement (BDCP Section 3.4.6.4), valley/foothill riparian restoration (BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (BDCP Section 3.4.9.4), and nontidal marsh restoration (BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 4A would also protect and manage the following natural communities that contain wetlands: 103 acres of valley/foothill riparian, 188 acres of vernal pool/alkali seasonal wetland complex, and 119 of nontidal marsh. In addition, 1,060 acres of grasslands and 11,870 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Alternative 4A also includes the following Resource Restoration and Performance Principles (see Table 3-12 in Chapter 3, *Description of Alternatives*) to further guide the Environmental Commitments that would also contribute to establishing and maintaining the functions and values of restored and protected waters of the United States.

- Restore or create vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acres (Resource Restoration and Performance Principle VP/AW2).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).
- In grasslands surrounding protected and created vernal pools and alkali seasonal wetlands complex, increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (Resource Restoration and Performance Principle VP/AW6).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Protect up to six acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the conservation area, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

- Create and protect nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will include suitable habitat characteristics for western pond turtle (Resource Restoration and Performance Principle WPT1).
- Create aquatic habitat for the giant garter snake will be connected to the protected rice land or equivalent-value habitat (Resource Restoration and Performance Principle GGS1).
- Protect, restore, and/or create rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in Conservation Zones 4 and/or 5 (Resource Restoration and Performance Principle GGS3).
- Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principle GSC2).
- Create at least two 90-acre wetland complexes within the Stone Lakes NWR project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes NWR for greater sandhill crane (Resource Restoration and Performance Principle GSC3).

The project proponents will also implement AMM1–AMM7, AMM10, AMM12, AMM30, AMM34, and AMM36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the United States. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of waters of the United States and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Environmental commitments (Environmental Commitment 4–Environmental Commitment 10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 4A's Environmental Commitments (Environmental Commitment 4–Environmental Commitment 10) could alter the acreages and functions and values of wetlands and waters of the United States in the study area. Because these Environmental Commitments have not been defined to the level of site-specific footprints, it is not possible to specifically delineate and quantify these effects on wetlands and waters; however the project would conduct tidal restoration (Environmental Commitment 4), riparian restoration (Environmental Commitment 7), grasslands restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10) in areas that would likely contain wetlands. Of the 2,448 acres of restoration proposed for the project, 2,344 acres (96%) are planned to take place in cultivated lands that likely contain agricultural ditches and seasonal wetlands (as was identified during the delineation for the Conveyance Planning Area). The proportion of cultivated areas that actually contain waters and wetlands is expected to be low; however for the purposes of this analysis a conservative estimate of 10% was applied to estimate the amount of wetlands and waters that may be affected within these areas, which would be 234 acres, plus the 49 acres of wetland natural communities estimated to be affected by tidal restoration brings the total estimate of wetland areas affected by restoration to 283 acres.

Alternative 4A would result in the restoration of approximately 1,175 acres of wetlands and waters (tidal natural communities, vernal pool complex, and nontidal marsh), as well the protection and management of 307 acres of wetland natural communities (vernal pool complex and nontidal marsh) and 13,033 acres of other natural communities that likely contain some degree of wetlands and waters (valley/foothill riparian, grasslands, and cultivated lands). As discussed above, Alternative 4A would also implement AMMs, Resource Restoration and Performance Principles, and adaptive management and monitoring together with these Environmental Commitments. The Environmental Commitments and associated measures could serve the dual purpose of offsetting effects to species and mitigation impacts on waters of the United State; however, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing these Environmental Commitments under Alternative 4A pursuant to USACE's and U.S. EPA's Mitigation Rule. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be available to address adverse impacts on waters of the United States.

NEPA Effects: The implementation of Environmental Commitment 4–Environmental Commitment 10 for Alternative 4A would potentially result in the conversion of wetlands and waters in cultivated lands and along the margins of Delta channels. These wetlands and waters would likely be converted to tidal and nontidal wetlands, including some open water, and possibly grasslands through implementation of Environmental Commitment 4, Environmental Commitment 8, and Environmental Commitment 10. Although, the increase in wetland acreage and wetland functions from these Environmental Commitments could offset the effects on waters of the United States occurring in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that these effects are not adverse.

***CEQA Conclusion*:** The implementation of Environmental Commitment 4–Environmental Commitment 10 for Alternative 4A would potentially result in the conversion of wetlands and waters in cultivated lands and along the margins of Delta channels. These wetlands and waters would likely be converted to tidal and nontidal wetlands, including some open water, and possibly grasslands through implementation of Environmental Commitment 4, Environmental Commitment 8, and Environmental Commitment 10. Although, the increase in wetland acreage and wetland functions from these Environmental Commitments could offset the effects on waters of the United States occurring in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the United States*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the Environmental Commitments, on shorebirds and waterfowl. Managed wetlands, tidal and nontidal natural communities, grasslands, vernal pools, alkali seasonal wetlands, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds.

Alternative 4A would result in both temporary and permanent losses of shorebird and waterfowl habitat. Full implementation of Alternative 4A would also include the following Environmental Commitments and associated Resource Restoration and Performance Principles that would benefit shorebirds and waterfowl through habitat restoration and protection.

- Restore or create up to 37 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create up to 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the south Delta (Environmental Commitment 10 and Resource Restoration and Performance Principle CBR1).
- Protect up to 119 acres of nontidal wetlands and create up to 832 acres of nontidal wetlands (Environmental Commitment 3 and Environmental Commitment 10).
- Protect up to 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3).
- Restore up to 1,070 acres of grassland (Environmental Commitment 8).
- Restore vernal pool complex and alkali seasonal (Environmental Commitment 9).

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities would result in the permanent removal of approximately 22 acres of managed wetland, 3 acres of tidal wetlands, 61 acres of nontidal wetlands, 1 acre of alkali seasonal wetland, 19 acres of vernal pool complex, 467 acres of grasslands, and 3,768 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 29 acres of managed wetland, 15 acres of tidal wetlands, 15 acres of nontidal wetlands, 3 acres of vernal pool complex, 158 acres of grasslands, and 1,339 acres of suitable cultivated lands would be temporarily impacted. No rice would be impacted as a result of constructing the water conveyance facilities. These losses of habitat would occur within the first 10–14 years of Alternative 4A implementation in the Delta.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected and 1,070 acres of grassland would be restored through Alternative 4A. In addition, 295 acres of tidal freshwater emergent wetland would be restored or created and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created in the Delta. The restored and protected acres described above would provide suitable nesting and/or foraging habitat for these species. These conservation actions would be associated with the aforementioned Environmental Commitments and would occur in the same timeframe as the construction losses. Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

NEPA Effects: Habitat loss from construction of the Alternative 4A water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse effect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

CEQA Conclusion: Habitat loss from construction of the Alternative 4A water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, which would identify birds prior to disturbance and would allow for avoidance measures, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Alternative 4A Environmental Commitments

The implementation of Environmental Commitments would result in the permanent loss or conversion of 2,295 acres of cultivated lands and natural communities suitable for wintering waterfowl.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20 acres of managed wetlands, 1 acre of nontidal wetlands, 25 acres of vernal pool complex, 1 acre of alkali seasonal wetland, 40 acres of grassland, and 54 acres of cultivated lands.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 1 acre of grassland and 251 acres of cultivated lands.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of cultivated lands

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected and 1,070 acres of grassland would be restored through Alternative 4A. In addition, 295 acres of tidal freshwater emergent wetland would be restored or created and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created in the Delta. Some portion of these wetlands would be expected to provide suitable habitat for wintering waterfowl. The restored and protected acres described above would provide foraging habitat for wintering waterfowl and the acres of cultivated lands protected would provide adequate food sources and resting habitat for waterfowl species. Restoration and protection acres would be associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 8, Environmental Commitment 9, and Environmental Commitment 10 and would occur in the same timeframe as the construction and early restoration losses. Environmental Commitment 11 would be implemented to guide management of cultivated lands and wetlands for shorebird and waterfowl species.

***NEPA Effects*:** The loss or conversion of 2,295 acres of cultivated lands and natural communities suitable for wintering waterfowl would not be adverse under NEPA because project proponents have committed to restoring and protecting an acreage that exceeds the typical mitigation ratios for cultivated lands (1:1 protection). This habitat protection and restoration would not be expected to substantially alter food productivity for wintering waterfowl in the Delta. Therefore the implementation of Alternative 4A would not represent an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** The loss or conversion of 2,295 acres of cultivated lands and natural communities suitable for shorebirds and waterfowl would not represent a substantial impact because project proponents have committed to restoring and protecting an acreage that exceeds the typical mitigation ratios for cultivated lands (1:1 protection). This habitat protection and restoration would not be expected to substantially alter food productivity for wintering waterfowl in the Delta. Therefore the implementation of Alternative 4A would have a less-than-significant impact on wintering waterfowl.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Alternative 4A Environmental Commitments

The implementation of Environmental Commitments would result in the permanent loss or conversion of 88 acres of natural communities suitable for breeding waterfowl.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 20 acres of managed wetlands, 1 acre of nontidal wetlands, 25 acres of vernal pool complex, 1 acre of alkali seasonal wetland, and 40 acres of grassland.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 1 acre of grassland.

Alternative 4A would protect up to 119 acres and create up to 832 acres of nontidal marsh. In addition, 295 acres of tidal freshwater wetlands would be restored in the Delta which would be expected to contain water during the breeding period (March through July). Up to 119 acres of nontidal wetlands would be protected and 832 acres of nontidal wetlands would be created in the Delta. Restoration and protection acres would be associated with Environmental Commitment 3, Environmental Commitment 4, and Environmental Commitment 8, Environmental Commitment 10 and would occur in the same timeframe as the construction and early restoration losses. Environmental Commitment 11 would be implemented to guide management of habitat for breeding waterfowl. Construction activities could have an adverse effect on nesting waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

NEPA Effects: Habitat loss from the implementation of Environmental Commitments would not result in an adverse effect on breeding waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse effect on nesting waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

CEQA Conclusion: Habitat loss from the implementation of Environmental Commitments would not result a significnat impact on breeding waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, which would require identification of birds prior to disturbance and would allow for avoidance measures, would reduce this impact on nesting birds to a less-than-significant level.

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from the Implementation of Alternative 4A Environmental Commitments

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet, killdeer, and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Vernal pool complex and alkali seasonal wetland also provide nesting habitat for American avocet (Shuford et al. 2004). Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20 cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (*Charadrius semipalmatus*), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

No managed wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, or Environmental Commitment 10. However, 832 acres of nontidal marsh would be created under Environmental Commitment 10.

Cultivated Lands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Within the Delta, 54 acres of cultivated lands would be permanently converted to tidal wetlands as a result of tidal restoration (Environmental Commitment 4), 251 acres would be permanently lost as a result of riparian restoration (Environmental Commitment 7), 1,070 acres would be converted to grassland as a result of grassland restoration (Environmental Commitment 8), and 832 acres would be converted to nontidal wetlands as a result of nontidal marsh restoration (Environmental Commitment 10).

Tidal Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

No tidal wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, Environmental Commitment 8, or Environmental Commitment 10. However, 295 acres of tidal wetlands would be created under Environmental Commitment 4.

Nontidal Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

No nontidal wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, or Environmental Commitment 10. However, 832 acres of nontidal wetlands would be created under Environmental Commitment 10.

The protection and restoration of natural communities would also include management and enhancement actions under *Environmental Commitment 11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under Environmental Commitment 11 in areas where they would not conflict with other species management.

- Managed wetlands and Nontidal Wetlands:
  - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
  - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
  - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
  - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.
  - Create low slopes on islands and levees; gradual angles (10–12:1) are better than steep angles.
  - Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
  - Potentially add material to levees or to islands to encourage nesting for some species.
- Cultivated Lands:
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).

- The post-harvest flooding of winter wheat and potato fields in early fall (July- September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
- Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
- Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
- Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).
- Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
- Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
- When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
- Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
- Maintain gently sloping levees and island sides (10–12:1; Iglecia et al. 2012).
- Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

NEPA Effects: Alternative 4A implementation would result in the conversion of cultivated lands in the Delta to tidal and nontidal wetlands. The result would be a loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While losses of cultivated lands would be incurred, protection, enhancement, and management of 11,870 acres of cultivated lands would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by Swainson's hawk, giant garter snake, and greater sandhill crane, they would also benefit shorebirds with the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*. Habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

CEQA Conclusion: Alternative 4A implementation would result in the conversion of cultivated lands in the Delta to tidal and nontidal wetlands. The result would be a loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, killdeer, and willet. While losses of cultivated lands would be incurred, protection, enhancement, and management of 11,870 acres of cultivated lands would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by Swainson's hawk, giant garter snake, and greater sandhill crane, they would also benefit shorebirds with the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*. Habitat conversion would not be expected to adversely affect shorebird populations in the study area. With the protection and restoration of acres in the Delta watershed, in addition to the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other avoidance and minimization measures. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight-diverters on new transmission lines and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes which could have a substantial adverse effect as a result of direct mortality. This impact would be significant. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes which could have a substantial adverse effect as a result of direct mortality. This impact would be significant. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of powerline strikes from the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect Construction- and Operation-Related Effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Project activities have the potential to exacerbate bioaccumulation of mercury in shorebird and waterfowl species. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) foodwebs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic foodwebs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification. Shorebirds and waterfowl that forage on invertebrates and bivalves, may therefore have lower concentrations of methylmercury than diving ducks that forage on fish. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix 11F, *Substantive BDCP Revisions*,. The review includes an overview of the project-related mechanisms that could result in increased mercury in the foodweb, and how exposure of individual species to mercury may occur based on feeding habits and where species habitat overlaps with the areas where mercury bioavailability could increase.

Largemouth bass was used as a surrogate species for analysis and the modeled effects of mercury concentrations from changes in water operations under water conveyance facilities on largemouth bass did not differ substantially from existing conditions (see Appendix 11F, *Substantive BDCP Revisions*); therefore, results also indicate that shorebird and waterfowl mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas (Environmental Commitment 4) could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels without the project, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, Environmental Commitment 12, is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 will be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This Environmental Commitment will include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and project activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium (see Chapter 3, *Conservation Strategy*, of the BDCP for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with Environmental Commitment 4 would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, (see Appendix 3B, *Environmental Commitments, AMMs, and CMs*). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Noise and visual disturbances from the construction of Alternative 4A water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 4A implementation would not have an adverse effect on shorebirds and waterfowl.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on shorebirds and waterfowl.

CEQA Conclusion: Indirect effects that include noise and visual disturbance, potential hazardous spills, increased dust and sedimentation, and increased methylmercury and selenium exposure as a result of Alternative 4A water conveyance facilities construction and operation and maintenance would represent an adverse effect as a result of habitat modification and potential for direct mortality of shorebirds and waterfowl in the absence of the environmental commitments and AMMs. This would be a significant impact.

AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce potential adverse effects of noise, visual disturbance and potential for spills, dust, and sedimentation.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. This could result in a significant impact. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on shorebirds and waterfowl.

Therefore, with AMM1–AMM7, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not all covered under laws or regulations that address conservation or protection of individual species. Common wildlife do have some level of protection under California Fish and Game Code and most bird species have protections under the Migratory Bird Treaty Act. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in the analysis of Alternative 4A effects on natural communities (Impacts BIO-1 through BIO-21). In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the project over a 15-year time period, several natural communities and land cover types would be reduced in size, primarily from construction of the water conveyance facility, but also from restoration of other natural communities. Grassland, managed wetland and cultivated lands would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement, and management actions under Alternative 4A, including *Environmental Commitment 3 Natural Communities Protection and Restoration*, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing Environmental Commitments would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife, including increased traffic on local roads from construction vehicles that could increase wildlife mortality and impede wildlife movement. Effects of construction traffic on wildlife moving in the vicinity of Stone Lakes NWR would be minimized by *AMM20 Greater Sandhill Crane*, which includes a measure for the installation of a vegetation screen or other noise and visual barrier along Hood Franklin Road for the benefit of cranes, which would be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and which would provide a continuous surface impenetrable by light. This measure would potentially direct wildlife wishing to cross Hood Franklin toward the overcrossing of the canal that links the Stone Lakes properties just east of the town of Hood. The overcrossing includes strips of terrestrial habitat on either side of the canal.

Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants).

***NEPA Effects*:** The direct and indirect effects associated with implementing the Environmental Commitments of Alternative 4A would not be adverse because the Environmental Commitments and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

***CEQA Conclusion*:** Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Environmental commitments to avoid or minimize effects on special-status species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of Alternative 4A is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

Essential Connectivity Areas (ECAs) are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effects of Alternative 4A on Wildlife Corridors

Alternative 4A water conveyance facilities would cross two of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA and the Mandeville Island-Staten Island ECA.

The construction of Intakes 2 and 3, temporary tunnel work areas, and RTM areas would occur within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the Sacramento River and the permanent and temporary loss of cultivated lands. Alternative 4A would not substantially increase impediments to movement of any nonavian wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento River Deep Water Ship Channel already create a barrier to dispersal for nonavian species. However, the conversion of riparian and cultivated lands and the presence of the intakes would locally constrict the north-south movement of nonavian terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River. No records of wildlife species were identified within these construction footprints, though there are several records for Swainson's hawk in the vicinity. Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The addition of temporary transmission lines within the Stone Lake-Yolo Bypass ECA, which would be in place for approximately 7 years, could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes and by the east-west transmission line between Stone Lakes and the Cosumnes Preserve; however, this line would generally parallel an existing transmission line. Because the proposed east-west transmission line parallels an existing line and would only be in place for approximately 7 years it would not likely create a barrier to the future movement of cranes in this area (see impact discussions for greater and lesser sandhill cranes).

The Alternative 4A conveyance facilities would also pass through the Mandeville Island-Staten Island ECA, which also has several know roost locations for greater sandhill crane. Within this ECA, Alternative 4A would result in the construction of a large RTM disposal area on Bouldin Island, permanent access roads on Bouldin and Mandeville Islands, and temporary transmission lines across most of the ECA. As discussed above, the temporary transmission lines could adversely affect the movement of cranes and other bird species during periods of low visibility. The RTM disposal area may create a physical barrier to movement for some species and could make this area unusable as wildlife habitat for close to 10 years during the tunnel construction. The access roads are mostly located on existing dirt and paved roads and would therefore not create any new physical barriers but could temporarily increase road mortality during periods of construction. The conveyance alignment at this location would be within the tunnel and thus not create a barrier to wildlife movement.

Alternative 4A conveyance facilities would create some localized disruption in wildlife movement and the temporary and permanent transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 4A alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts (the intakes) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel).

Restoration activities may occur in some of the ECAs. These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (Environmental Commitment 3) and the enhancement and management of these areas (Environmental Commitment 11) would improve and maintain wildlife corridors within the study area.

NEPA Effects: Alternative 4A conveyance facilities would create local barriers to dispersal but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4A would not adversely affect wildlife corridors.

CEQA Conclusion: Alternative 4A conveyance facilities would create local barriers to dispersal and create barriers to safe movement of avian species during periods of low visibility but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4A would result in less-than-significant impacts on wildlife corridors.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4, *Invasive and Noxious Plant Species*. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities associated with Alternative 4A could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of Alternative 4A are listed here.

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.

- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from four activities.

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, RTM, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-4A-69 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 4A.

Table 12-4A-69. Summary of Temporary Disturbance in Natural Communities under Alternative 4A

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	2,098
Tidal brackish emergent wetland	0
Tidal freshwater emergent wetland	15
Valley foothill riparian	31
Grassland	151
Inland dune scrub	0
Alkali seasonal wetland complex	0
Vernal pool complex	3
Other natural seasonal wetland	0
Nontidal freshwater perennial emergent wetland	6
Nontidal perennial aquatic	10
Managed wetlands	29
Cultivated lands	1,309
Total	**3,652**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Alternative 4A would have adverse effects on natural communities as a result of the introduction and spread of invasive plant species through implementation of water conveyance facilities, Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, Environmental Commitment 9, Environmental Commitment 10 and AMM6. No adverse effects are expected from implementation of other project-related Environmental Commitments.

- *Water Facilities and Operations*: Construction of the Alternative 4A water conveyance facilities would result in the temporary disturbance of 3,652 acres that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in planned conservation areas would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the project proponents would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the project proponents would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *Environmental Commitment 6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes, primarily in CZ 8, would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of agricultural lands primarily in CZ 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for

colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.

- *Avoidance and Minimization Measures*: *AMM6 Disposal and Reuse of Spoils* would have adverse effects if spoils, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of Environmental Commitment 11, AMM4, AMM10, and AMM11.

Environmental Commitment 11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the Alternative 4A restoration areas to reduce competition on native species, thereby improving conditions for special-status species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10, and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would involve the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would involve methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the project proponent would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed ~~of~~ to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the Environmental Commitments, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any Alternative 4A restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the study area. Cleaning stations would be established at the perimeter of Alternative 4A activities along construction routes as well as at the entrance to conservation area lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

NEPA Effects: The implementation of AMM4, AMM10, and AMM11, and Environmental Commitment 11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

CEQA Conclusion: Under Alternative 4A, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing Alternative 4A would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be considered less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities and implementing associated Environmental Commitments for Alternative 4A have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*. This overview of plan and policy compatibility evaluates whether Alternative 4A would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 4A on terrestrial biological resources are addressed in the impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the project.

Federal and State Legislation

- The federal Clean Water Act, Endangered Species Act, Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, Rivers and Harbors Act and Marine Mammal Protection Act all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decisionmaking. The goals and objectives contained in Alternative 4A that provide the major guidance for implementing the various project elements of Alternative 4A are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the study area. While some of the Environmental Commitments of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term implementation of the project would provide for the long-term viability and expansion of the habitats and special-status species populations in the study area.

Alternative 4A Environmental Commitments would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.

- The California Endangered Species Act, California Native Plant Protection Act, Porter-Cologne Water Quality Control Act, and Natural Communities Conservation Planning Act are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. Alternative 4A contains goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 4A Environmental Commitments would be compatible with the policies and directives contained in these laws.

- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are project proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The project's goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).

- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. Alternative 4A would not affect Suisun Marsh; therefore, it would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The project is intended to contain water management and Environmental Commitments consistent with the Delta Plan. The Delta Stewardship Council will determine whether the project is compatible with the goals and objectives of the Delta Plan prior to its approval. The compatibility of the project with the Delta Plan is considered in detail in Section 13.2.2.2, *The Delta Plan*.

- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. The project's Environmental Commitments that provide for an expansion of wetland acreage and quality in the Delta are compatible with the intent of the California Wetlands Conservation Policy.

- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The project study area includes all or portions of three Implementation Plan basins— the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

Implementation of the Alternative 4A Environmental Commitments would result in reductions in cultivated land and managed wetland acreage in the Delta only; however, increases in tidal and nontidal wetlands in this basin would be another result. The project also contains a significant commitment to long-term protection of agricultural land (over 9,000 acres) for waterfowl, shorebirds and other sensitive wildlife species. The sum of these actions would be consistent with the objectives of the Implementation Plan.

- *Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan*, *Cosumnes River Preserve Management Plan*, *Brannan Island and Franks Tract State Recreation Areas General Plan*, and the *Lower Sherman Island Wildlife Area Land Management Plan* are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 4A, especially construction of water conveyance facilities, and land modification associated with Environmental Commitment 4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The proposed intermediate forebay and the RTM area on Zacharias Island fall within the Stone Lakes Cooperative Wildlife Management Area identified in the Stone Lakes Wildlife Refuge CCP. The primary objective of the Cooperative Wildlife Management Area is to maintain lands in private ownership and continue agricultural production but also allow USFWS to pursue a number of approaches to conserve and manage lands, depending on the preferences of willing landowners. The location of the intermediate forebay is an area that is entirely planted in vineyard, which has very little to no habitat value for wildlife species. The RTM area is used for hay or grain production, which does have high value for wildlife species. Project activities in these areas would conflict with the CCP.

  The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the project would be compatible with the overall long-term management goals of these areas. Proposed restoration areas in the Delta would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.

- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act.

Alternative 4A would not directly or indirectly affect the Suisun Marsh and its natural habitats; therefore, it would be consistent with the Plan's management goals.

- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the project's habitat management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that the project's objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of project's Environmental Commitments would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative 4A would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans and Natural Community Conservation Plans* are the subject of a detailed analysis in Section 12.3.6, *Effects on Other Conservation Plans*. The analysis considers the compatibility of the alternatives with all HCPs and NCCPs that share planning area with the study area. The Alternative 4A study area overlaps geographically with six conservation plans. The water conveyance facilities construction actions would still overlap with the South Sacramento, San Joaquin, East Contra Costa and East Alameda County planning areas, but there would be little effect on implementation of the HCP/NCCPs for these areas. The Environmental Commitments associated with Alternative 4A would remove relatively small acreages of primarily cultivated land in all six of the overlapping plan areas (Yolo, Solano, South Sacramento, East Contra Costa, East Alameda and San Joaquin County HCP/NCCPs). The consistency analysis below indicates that the degree to which the competition for conservation lands would impact the conservation goals of other plans is limited. Alternative 4A would have much less risk from competition for conservation lands. In most cases, because of the flexibility for acquisition targets incorporated into Alternative 4A and other plans, the potential conflict would be manageable, and significant conflicts with the implementation of overlapping plans could be avoided. In certain cases, especially pertaining to similar restoration objectives, perceived conflicts may also represent opportunities for collaboration to jointly achieve similar conservation goals. Because implementing Alternative 4A would not result in a conflict with the provisions of an adopted HCP, NCCP or other approved local, regional or state habitat conservation plan, there would be a less-than-significant impact.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The project proposes to protect, enhance and expand the wetlands of the study area, and, therefore, would be compatible with Executive Order 11990.

- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 4A construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of AMM11, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, could make Alternative 4A implementation compatible with Executive Order 13112.

- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 4A Environmental Commitments that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion Environmental Commitments of Alternative 4A would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

***NEPA Effects*:** The potential plan and policy incompatibilities of implementing Alternative 4A identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the *Shorebirds and Waterfowl* analysis above, and no additional NEPA effects determination is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Chapter 13, Section 13.2, *Regulatory Setting*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

***CEQA Conclusion*:** The potential plan and policy incompatibilities of implementing Alternative 4A identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the *Shorebirds and Waterfowl* analysis above, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Chapter 13, Section 13.2, *Regulatory Setting*, for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

12.3.4.3 Alternative 2D—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 1, 2, 3, 4, and 5 (15,000 cfs; Operational Scenario B)

Alternative 2D is generally similar to Alternative 4A except that Alternative 2D includes two additional intakes (Intakes 1 and 4) along the Sacramento River and operates under a different operational scenario. Like Alternative 4A, this alternative would not serve as an NCCP/HCP and thus the analysis below only considers construction and operation of the conveyance facilities and only includes the Environmental Commitments necessary to fully mitigate the project's impacts under CEQA and NEPA. Other than the increased impacts from the intakes and associated restoration actions, the effects from Alternative 2D would be relatively the same as those under Alternative 4A; therefore, Alternative 2D is considered here in a summary fashion. The reader is referred to the discussion of Alternative 4A for a detailed analysis of impacts that would be associated with implementing Alternative 2D. The impacts associated with Alternatives 2D and 4A were derived by comparing the alternative with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Operations under Alternative 2D would be similar, but not identical, to those described under Operational Scenario B (see Chapter 3, Section 3.6.4.2, *North Delta and South Delta Water Conveyance Operational Criteria*). These operations would include both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Operations included in this alternative for south Delta export facilities would replace the south Delta operations currently implemented in compliance with the USFWS (2008) and NMFS (2009) BiOps. The north Delta intakes and the head of Old River barrier would be new facilities for the SWP and CVP and would be operated as described in Chapter 3, Section 3.6.4.2. Alternative 2D operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times. The operational scenario under Alternative 2D would have a greater operational capacity than the Alternative 4A operational scenario would have (15,000 cfs compared with 9,000 cfs).

Comparative Differences in Effects for Alternatives 2D and 4A

The principal differences in effects between these two alternatives are related to the differing construction footprints of the water conveyance facilities and the differences in proposed restoration efforts. The Alternative 2D water conveyance facilities would entail construction of two additional north Delta intakes (Intakes 1 and 4). Intake 1 would be located northeast of Clarksburg on the east side of the river, and Intake 4 would be located just south of Hood, also on the east side of the river. There also would be a large RTM disposal area and a new permanent transmission line between Intakes 1 and 2. The operational scenario for Alternative 2D (Scenario B) is also different from Alternative 4A (Scenario H3–H4), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area. Under Alternative 4A, geotechnical exploration within conveyance construction areas would cause temporary impacts. Alternative 2D would not cause geotechnical exploration impacts.

As a result of the greater impacts from Alternative 2D, additional restoration and protection acreages would be required under the Environmental Commitments to achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b). The restoration actions would themselves result in effects on natural communities where they are likely to occur. Specific locations for implementing many of the restoration commitments have not been identified at this time. Therefore, the analysis considers typical activities that would be undertaken for implementation of the habitat restoration and provides an estimate of what acreages of natural communities would be lost or converted by these activities. These activities under Alternative 2D would generally be the same as those under Alternative 4A but would result in additional impacts on grassland and cultivated lands natural communities. The effects from these activities are summarized below in Table 12-2D-1. The temporary impacts from geotechnical exploration under Alternative 4A were not included for the comparison of temporary impacts for Alternative 2D to Alternative 4A in Table 12-2D-1.

Due to the addition of the two intakes and their associated pumps and pipelines, the additional RTM disposal area, and the additional restoration under the Environmental Commitments, Alternative 2D would create differences in the permanent and temporary loss of natural communities and cultivated lands when compared with Alternative 4A (Table 12-2D-1). Alternative 2D would permanently remove 8 more acres of valley/foothill riparian habitat along the Sacramento River, 8 acres more of grassland, 74 acres more of managed wetlands, 5 more acres of tidal perennial aquatic habitat, and 919 acres more of cultivated land when compared with Alternative 4A.

During the water conveyance facilities construction process, Alternative 2D would result in 10 fewer acres of temporary loss of natural communities when compared with Alternative 4A because Intake 4 under Alternative 2D would be placed within the large intake work area under Alternative 4A that is located just south of the town of Hood (see Figure 3-2). The difference is due to decreased temporary impacts on cultivated lands (32 fewer acres); however, Alternative 2D would also result in greater impacts on tidal perennial aquatic (14 acres more), valley foothill riparian (4 acres more), and grassland (3 acres more) natural communities as a result of two more intakes along the Sacramento River. No temporary impacts from restoration actions are anticipated because all restoration activities would take place within in the footprint of the proposed restoration site.

These differences in permanent loss of habitat associated with water conveyance construction and habitat restoration would create some differences in effects on wildlife, primarily birds that utilize croplands for foraging and some species that utilize managed wetlands in the north Delta. The increase in permanent loss of cultivated land associated with Alternative 2D would result in a larger loss of habitat for species such as tricolored blackbird, greater sandhill crane, Swainson's hawk, white-tailed kite, western burrowing owl, short-eared owl, loggerhead shrike, northern harrier, and California horned lark. The increase in impacts on managed wetland would result in increased impacts on, white-tailed kite, northern harrier, yellow-head blackbird, and short-eared owl but the particular area of managed wetland that would be affected is not identified as suitable for greater sandhill crane (i.e., is not included as part of the species' modeled habitat). Alternative 2D would also result in an increase in the loss of riparian habitat along the Sacramento River, which would affect nesting habitat for Swainson's hawk, white-tailed kite, cormorants, herons, egrets, and migratory habitat for birds moving along the Sacramento River corridor. Alternative 2D would also result in greater impacts on giant garter snake aquatic and upland habitats.

Overall, the temporary losses of habitat for species would be less under Alternative 2D than under Alternative 4A, except for species restricted primarily to riparian habitats such as valley elderberry longhorn beetle, least Bell's vireo, and yellow-breasted chat, and species restricted to tidal perennial aquatic habitat, such as California least tern, where impacts would increase. Species with relative decreases in temporary habitat losses include greater sandhill crane, Swainson's hawk, tricolored blackbird, western burrowing owl, and white-tailed kite. Overall, when combining permanent and temporary impacts, Alternative 2D would result in greater impacts on species than Alternative 4A.

. Alternative 2D would also affect 35 more acres of jurisdictional wetlands and waters as regulated by Section 404 of the CWA, when compared with Alternative 4A (Table 12-2D-2). Refer to Table 12-4A-68 for a summary of Alternative 4A jurisdictional waters and wetlands impacts. The majority of this difference is due to impacts on tidal channel and scrub-shrub wetlands (as mapped for the wetland delineation) as a result of construction of the intakes along the Sacramento River.

The Environmental Commitments described in Chapter 3, *Description of Alternatives*, Section 3.6.3 and the acreages of these commitments presented in Table 3-10, in Chapter 3, would provide for protection, enhancement, and restoration of habitats affected under Alternative 2D. In addition, the Resource Restoration and Performance Principles in Table 3-12 in Chapter 3, *Description of Alternatives*, would further guide the environmental commitments in mitigating the effects on terrestrial biological resources. AMM1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30, AMM38, and AMM39, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be available to further avoid and minimize impacts, and preparation of an adaptive management and monitoring program as would likely be required during the ESA Section 7 and CESA Section 2081(b) process would further avoid, minimize, and mitigate the effects of Alternative 2D.

Table 12-2D-1. Alternative 2D Effects on Natural Communities Relative to Alternative 4A (acres)

	Permanent Impacts from Alternative 2D									
Natural Community	Water Conveyance	EC 4 – Tidal Restoration	EC 7 – Riparian Restoration	EC8 – Grassland Restoration	EC 10 – Nontidal Restoration	EC11 – Enhancement and Management	*Permanent Impact Total*	Permanent Impact Difference from Alternative 4A	*Temporary Impacts Alternative 2D*	Temporary Impact Difference from Alternative 4A
Tidal perennial aquatic	285	0	0	0	0	0	*285*	5	*2,010*	15
Tidal brackish emergent wetland	0	0	0	0	0	0	*0*	0	*0*	0
Tidal freshwater emergent wetland	1	0	0	0	0	0	*1*	0	*8*	0
Valley/foothill riparian	44	11	0	0	0	0	*55*	8	*22*	4
Nontidal perennial aquatic	58	2	0	0	0	0	*60*	0	*3*	0
Nontidal freshwater perennial emergent wetland	2	1	0	0	0	0	*3*	0	*2*	0
Alkali seasonal wetland complex	1	1	0	0	0	0	*2*	0	*0*	0
Vernal pool complex	19	25	0	0	0	0	*44*	0	*3*	0
Managed wetland	91	20	0	0	0	0	*111*	74	*15*	0
Other natural seasonal wetland	0	0	0	0	0	0	*0*	0	*0*	0
Grassland	475	41	1	0	0	20	*537*	8	*136*	3
Inland dune scrub	0	0	0	0	0	0	*0*	0	*0*	0
Cultivated lands	3,876	196	291	1,088	1,356	0	*6,808*	919	*872*	-32

Table 12-2D-2. Alternative 2D Effects on Jurisdictional Wetlands and Waters Relative to Alternative 4A (acres)

	Alternative 2D Impacts on Jurisdictional Wetlands and Waters				
Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]	Difference from 4A[d]
Agricultural Ditch	45.3	13.5	0	58.8	3.4
Alkaline Wetland	10.4	0.1	0	10.5	0
Clifton Court Forebay	257.9	0	1,930.6	257.9	0
Conveyance Channel	7.1	2.9	0	10.0	0
Depression	29.3	6.2	0	35.5	0
Emergent Wetland	56.8	14.7	0	71.5	0
Forest	7.3	5.3	0	12.6	0.2
Lake	23.2	0	0	23.2	0
Scrub-Shrub	25.2	4.1	0	29.3	13.0
Seasonal Wetland	114.5	10.0	0	124.5	0
Tidal Channel	19.4	80.2	0	99.6	18.8
Vernal Pool	0.3	0	0	0.3	0
Total	**597**	**137**	**1,931**	**734**	**35.4**

[a] Temporary impacts treated as permanent are temporary impacts expected to last more than 1 year. These impact sites would eventually be restored to pre-project conditions; however, because of the duration of effect, compensatory mitigation would be included for these areas.

[b] Temporary impacts would result from dredging Clifton Court Forebay.

[c] Total does not include temporary impacts on Clifton Court Forebay because these would be temporary disturbance to open water, which typically does not require compensatory mitigation.

[d] Difference in total impacts between Alternatves 2D and 4A.

NEPA Effects: Alternative 2D would not have adverse effects on the terrestrial natural communities, special-status species, and common species that occupy the study area. As with Alternative 4A, this alternative also would not substantially disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, Alternative 2D would result in existing habitat converted by water conveyance facilities construction and restoration actions but to a slightly larger degree than under Alternative 4A. The temporarily affected habitat would be restored to its pre-project condition and the restoration under Environmental Commitments 4, 6–8, 10, and11 would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The Environmental Commitments would result in the protection of up to 15,012 acres and restoration of up to 3,085 acres of natural communities to offset effects. Where Environmental Commitments would not fully offset effects, AMM1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30, AMM38, and –AMM39, and in some cases specific mitigation measures have been developed to avoid and minimize adverse effects. Alternative 2D would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

CEQA Conclusion: Alternative 2D would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species, and common species that occupy the study area. As with Alternative 4A, this alternative also would not significantly disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, existing habitat would be converted during construction of water conveyance facilities and the associated restoration to offset these impacts. The temporarily affected habitat would be restored to its pre-project condition and the restoration measures (Environmental Commitments 4, 6–8, 10, and11) would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The Environmental Commitments would result in the protection of up to 15,012 acres and restoration of up to 3,805 acres of natural communities and, together with AMM1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30,AMM38, and AMM39, and in some cases specific mitigation measures would mitigate the projects impacts to a less-than significant-level. Alternative 2D would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

As with Alternative 4A, Alternative 2D would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the Environmental Commitments and AMMs provided by Alternative 2D. The relevant mitigation measures, which are included in detail in the analysis of Alternative 4A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

12.3.4.4 Alternative 5A—Dual Conveyance with Modified Pipeline/Tunnel and Intake 2 (3,000 cfs; Operational Scenario C)

Alternative 5A is generally similar to Alternative 4A except that it has only one intake (Intake 2) along the Sacramento River compared with the three under Alternative 4 A (Intakes 2, 3, and 5) and operates under a different operational scenario. Like Alternative 4A, this alternative would not serve as an NCCP/HCP and thus the analysis below only considers construction and operation of the conveyance facilities and only includes the Environmental Commitments necessary to fully mitigate the projects impacts under CEQA and NEPA. Other than the decreased impacts from the intakes and associated restoration actions, the effects from Alternative 5A would be relatively the same as those under Alternative 4A; therefore, Alternative 5A is considered here in a summary fashion. The reader is referred to the discussion of Alternative 4A for a detailed analysis of impacts that would be associated with implementing Alternative 5A. The impacts associated with Alternatives 5A and 4A were derived by comparing the alternative with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Operational components of the water conveyance facilities under Alternative 5A would be similar, but not identical, to those described under Scenario C in Chapter 3, Section 3.6.4.2, *North Delta and South Delta Water Conveyance Operational Criteria*. These operations would include both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Alternative 5A operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times. The operational scenario under Alternative 5A would have less operational capacity than the Alternative 4A operational scenario would have (3,000 cfs compared with 9,000 cfs).

Comparative Differences in Effects for Alternatives 5A and 4A

The principal differences in effects between these two alternatives would be related to the differing construction footprints of the water conveyance facilities and the differences in proposed restoration efforts. The Alternative 5A water conveyance facilities would entail construction of one north Delta intake (Intake 2). Intake 2 would be located southeast of Clarksburg on the east side of the river, which is the same location of Intake 2 under Alternative 4A. The operational scenario for Alternative 5A (Scenario C) is also different from Alternative 4A (Scenario H3–H4), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area.

As a result of fewer impacts from Alternative 5A, less habitat restoration and protection would be required under the Environmental Commitments to achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b). These restoration actions would themselves result in affects on natural communities where they are likely to occur. Specific locations for implementing many of the restoration commitments have not been identified at this time. Therefore, the analysis considers typical activities that would be undertaken for implementation of the habitat restoration and provides an estimate of what acreages of natural communities would be lost or converted by these activities. These activities under Alternative 5A would generally be the same as those under Alternative 4A but would result in fewer impacts on valley foothill riparian, grasslands, tidal perennial aquatic, and cultivated lands natural communities. The effects from these activities are summarized below in Table 12-5A-1.

Due to having fewer intakes and associated infrastructure and the decreased restoration under the Environmental Commitments, Alternative 5A would have fewer permanent and temporary losses of natural communities and cultivated lands when compared with Alternative 4A (Table 12-5A-1). Alternative 5A would permanently remove 5 fewer acres of valley/foothill riparian habitat along the Sacramento River, 13 fewer acres of grassland, 3 fewer acres of tidal perennial aquatic, and 226 acres fewer of cultivated land when compared with Alternative 4A.

During the water conveyance facilities construction process, Alternative 5A would involve less temporary loss of habitat when compared with Alternative 4A. The differences would consist of fewer impacts on cultivated lands east of the river (100 acres less), grassland along the river levee (3 acres less), tidal perennial aquatic within the river channel (18 acres less), and valley/foothill riparian along the river levee (5 acres less). No temporary impacts from restoration actions are anticipated because all restoration activities would take place within in the footprint of the proposed restoration site.

These differences in permanent loss of habitat associated with water conveyance construction and habitat restoration would create relatively minor differences in effects on wildlife. The decrease in permanent loss of cultivated lands creates the largest difference between the two alternatives' impacts on wildlife. Alternative 5A would result in less loss of habitat for sandhill cranes, tricolored blackbird, western burrowing owl, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark. The reduction in impacts on valley/foothill riparian habitat would result fewer impacts on breeding habitat for raptors, herons and egrets, Swainson's hawk, Cooper's hawk, and white-tailed kite, and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo. Alternative 5A would also result in fewer impacts on giant garter snake.

Alternative 5A would also cause slightly fewer temporary losses of cultivated land, grassland and valley/foothill riparian natural communities and thus decrease the impacts on the species that use these areas relative to Alternative 4A. There would be fewer acres of foraging habitat temporarily lost for sandhill cranes, tricolored blackbird, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark.

Alternative 5A would also permanently affect 25 fewer acres of jurisdictional wetlands and waters as regulated by Section 404 of the CWA, when compared with Alternative 4A (Table 12-5A-2). Refer to Table 12-4A-68 for a summary of Alternative 4A permanent and temporary jurisdictional waters and wetlands impacts. The majority of this difference is due to fewer impacts on tidal channel (21 fewer acres) with a small difference in impacts on scrub-shrub wetlands (3 fewer acres) as a result of fewer intakes along the Sacramento River.

The Environmental Commitments described in Chapter 3, *Description of Alternatives*, Section 3.6.3,3 and the acreages of these commitments presented in Table 3-11, in Chapter 3, would provide for protection, enhancement, and restoration of habitats affected under Alternative 5A. In addition, the Resource Restoration and Performance Principles in Table 3-12, in Chapter 3, would further guide the Environmental Commitments in mitigating the effects on terrestrial biological resources. AMM 1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30, AMM38, and AMM39, described in Appendix 3B, *Environmental Commitments, AMMs, and CMs*, would be available to further avoid and minimize impacts, and preparation of an adaptive management and monitoring program as would likely be required during the ESA Section 7 and CESA Section 2081(b) process would further avoid, minimize, and mitigate the effects of Alternative 5A.

Table 12-5A-1. Alternative 5A Effects on Natural Communities Relative to Alternative 4A (acres)

	Permanent Impacts from Alternative 5A									
Natural Community	Water Conveyance	EC 4 – Tidal Restoration	EC 7 – Riparian Restoration	EC8 – Grassland Restoration	EC 10 – Nontidal Restoration	EC 11- Enhancement and Management	Permanent Impact Total	Permanent Impact Difference from Alternative 4A	Temporary Impacts Alternative 5A	Temporary Impact Difference from Alternative 4A
Tidal perennial aquatic	277	0	0	0	0	0	*277*	-3	*1,977*	-18
Tidal brackish emergent wetland	0	0	0	0	0	0	*0*	0	*0*	0
Tidal freshwater emergent wetland	1	0	0	0	0	0	*1*	0	*8*	0
Valley/foothill riparian	32	10	0	0	0	0	*42*	-5	*14*	-5
Nontidal perennial aquatic	58	2	0	0	0	0	*60*	0	*3*	0
Nontidal freshwater perennial emergent wetland	2	1	0	0	0	0	*3*	0	*2*	0
Alkali seasonal wetland complex	1	1	0	0	0	0	*2*	0	*0*	0
Vernal pool complex	19	25	0	0	0	0	*44*	0	*3*	0
Managed wetland	16	20	0	0	0	0	*36*	0	*15*	0
Other natural seasonal wetland	0	0	0	0	0	0	*0*	0	*0*	0
Grassland	454	40	1	0	0	20	*515*	-13	*130*	-3
Inland dune scrub	0	0	0	0	0	0	*0*	0	*0*	0
Cultivated lands	3,386	190	212	1,043	832	0	*5,663*	-226	*804*	-100

Table 12-5A-2. Alternative 5A Effects on Jurisdictional Wetlands and Waters Relative to Alternative 4A (acres)

Habitat Type	Alternative 5A Impacts on Jurisdictional Wetlands and Waters				Difference from 4A[d]
	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]	
Agricultural Ditch	41.7	12.7	0	54.4	-1.0
Alkaline Wetland	10.4	0.1	0	10.5	0.0
Clifton Court Forebay	257.9	0	1,930.6	257.9	0.0
Conveyance Channel	7.1	2.9	0	10.0	0.0
Depression	29.3	6.2	0	35.5	0.0
Emergent Wetland	56.8	14.7	0	71.5	0.0
Forest	7.2	4.8	0	23.2	-0.5
Lake	23.2	0	0	23.2	0.0
Scrub-Shrub	11.2	1.9	0	13.0	-3.4
Seasonal Wetland	114.5	10.0	0	124.5	0.0
Tidal Channel	11.5	48.4	0	59.9	-20.9
Vernal Pool	0.3	0	0	0.3	0
Total	**571**	**102**	**1,931**	**673**	**-25**

[a] Temporary impacts treated as permanent are temporary impacts expected to last more than 1 year. These impact sites would eventually be restored to pre-project conditions; however, because of the duration of effect, compensatory mitigation would be included for these areas.
[b] Temporary impacts would result from dredging Clifton Court Forebay.
[c] Total does not include temporary impacts on Clifton Court Forebay because these would be temporary disturbance to open water, which typically does not require compensatory mitigation.
[d] Difference in total impacts between Alternatives 5A and 4A.

NEPA Effects: Alternative 5A would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. As with Alternative 4A, this alternative also would not substantially disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, Alternative 5A would result in existing habitat converted by water conveyance facility construction and habitat restoration actions but to a slightly smaller degree. The temporarily affected habitat would be restored to its pre-project condition and the restoration under Environmental Commitments 4, 6–8, 10, and11 would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The Environmental Commitments would result in the protection of up to 12,728 acres and restoration of up to 2,428 acres of natural communities to offset effects. Where Environmental Commitments would not fully offset effects, AMM1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30, AMM38, andAMM39, and in some cases specific mitigation measures have been developed to avoid and minimize adverse effects. Alternative 5A would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

CEQA Conclusion: Alternative 5A would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. As with Alternative 4A, this alternative also would not significantly disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, existing habitat would be converted construction of water conveyance facilities and the associated restoration to offset these impacts. The temporarily-affected habitat would be restored to its pre-project condition and the restoration measures (Environmental Commitments 4, 6–8, 10, and11) would permanently replace primarily cultivated land a with tidal and nontidal marsh, grassland, and riparian vegetation. The Environmental Commitments would result in the protection of up to 12,728 acres and restoration of up to 2,428 acres of natural communities and, together with AMM1–AMM7, AMM10, AMM12–AMM15, AMM18, AMM20–AMM25, AMM27, AMM30, AMM38, and AMM39, and some cases specific mitigation measures would mitigate the projects impacts to a less-than-significant level. Alternative 5A would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

As with Alternative 4A, Alternative 5A would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the Environmental Commitments and AMMs provided by Alternative 5A. The relevant mitigation measures, which are included in detail in the analysis of Alternative 4A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the United States

12.3.5 Cumulative Effects

12.3.5.1 Assessment Methodology

The cumulative effects analysis for terrestrial biological resources addresses the potential for the project alternatives to act in combination with other past, present, and reasonably foreseeable future projects, programs or conditions to create a cumulatively significant adverse impact. The analysis also considers whether any incremental effect of the alternative is cumulatively considerable. Chapter 4, Section 4.2, *Resource Chapter Organization*, provides the regulatory and statutory basis for the cumulative analyses found in this document.

The geographic scope of the analysis for natural communities is the terrestrial biology study area (the BDCP Plan Area and the two transmission corridors that extend beyond the Plan Area) and lands immediately adjacent to this study area where past, present or reasonably foreseeable activities might indirectly affect the natural communities in the study area. While the natural communities extend beyond these boundaries, the focus of the actions that might affect these resources is the Delta and other lands involved in project conservation efforts. The geographic scope of the cumulative analysis for each of the covered and noncovered species varies, depending on the potential for other projects or programs to influence individuals that rely on the study area for some stage of their life history. For some wildlife species, such as migratory birds, this area includes their entire range within California. For other species whose individuals do not range beyond the study area and its immediate surroundings, the geographic range of the cumulative analysis has been limited to this smaller area. The geographic scope for cumulative effects from spread of invasive species is the study area.

The projects and programs that have been considered as part of the cumulative analysis have been drawn primarily from a list developed for this EIR/EIS and contained in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*. This list was compiled in part by reviewing the projects addressed in the cumulative impacts analysis for the Delta Land Use and Resource Management Plan (Delta Protection Commission 2010). The list was augmented by reviewing the Appendix 3A, *Identification of Water Conveyance Alternatives, Conservation Measure 1*, and other recent environmental documents for Delta-area projects, and by coordinating with local, state, and federal agencies that are sponsoring activities in the Delta area or on other lands within the relevant range of individual species. The list of past, present and reasonably foreseeable future projects and programs has been evaluated to determine which of these activities may have effects on terrestrial habitats and terrestrial species that are known to occur within the study area. The list of projects and programs relevant to terrestrial biological resources is contained in Table 12-8. Most of these projects and programs are also a part of the NAA that is addressed in Section 12.3.3.1, *No Action Alternative,* and in Section 12.3.4.1, *Impacts of No Action Alternative Early Long-Term*.

In addition, the effects of global climate change have been considered in addressing the cumulative effects of alternatives on terrestrial biological resources. Changes that might occur within the study area related to climate change are considered reasonably foreseeable and part of the cumulative condition that might combine with the effects of the implementation of project alternatives. Climate change is also considered an element of the No Action Alternatives (see Section 12.3.3.1 and Section 12.3.4.1). Chapter 29, *Climate Change*, provides background and assumptions associated with climate change in the Plan Area, and also addresses general effects on terrestrial habitat and species.

To assess whether implementation of the alternatives would contribute to an adverse cumulative effect on the terrestrial biological resources of the study area, a judgment must first be made regarding potential adverse effects of the alternatives. Where adverse effects are anticipated, a determination must be made as to whether these effects would contribute to a cumulative adverse effect on a terrestrial biological resource. If there is a contribution to a cumulative adverse effect, a final judgment must be made as to whether the effect of the alternative represents a considerable contribution to the cumulative effect.

Table 12-8. Effects on Terrestrial Biological Resources from Plans, Policies and ProgramsConsidered for Cumulative Analysis

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
Alameda County	East Alameda County Conservation Strategy	Approved in 2011.	There is less than a 2% overlap with BDCP (4,643 acres) and this overlap only occurs in one conservation zone. The conservation strategy addresses the conservation needs of 19 species, including eight species that overlap with the BDCP. Currently no planned conservation activity in the overlap area, so the conservation strategy would not affect BDCP species in the Plan Area.	The East Alameda strategy has beneficial effects on eight of the BDCP covered species.
California Department of Fish and Wildlife	Calhoun Cut/Lindsey Slough Restoration		Increase intertidal marsh habitat and adjacent riparian habitat on 927 acres in Cache Slough ROA.	
California Department of Fish and Wildlife	Ecosystem Restoration Program Conservation Strategy	Ongoing implementation.	Created in 2000. Ongoing program to preserve, restore, and enhance terrestrial natural communities and ecosystems in the San Francisco Bay and Sacramento-San Joaquin Delta. Protected and restored more than 150,000 acres of habitat, including 3,900 acres and 59 miles of riparian and riverine aquatic habitat (as of 2010) after 7 of the planned 30 years of the project.	The conservation strategy creates beneficial impacts on the natural communities and special-status species discussed in this EIR/EIS.
California Department of Fish and Wildlife	Fremont Landing Conservation Bank	Ongoing implementation.	Enhances 40 acres of riparian habitat and restores 60 acres of riparian woodlands and sloughs.	This bank provides benefits for many riparian bird, reptile, and mammal species that occupy the Delta.

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
California Department of Fish and Wildlife	Grizzly Island Wildlife Area Land Management Plan		Estuarine marsh that contains about 15,300 acres of wildlife habitat. Will continue to be managed for wildlife, with an emphasis on waterfowl, threatened and endangered species, and the resident tule elk herd.	Actions at this wildlife area will maintain and enhance managed wetland as some of the private wetland is converted to tidal marsh.
California Department of Fish and Wildlife	Lower Sherman Island Wildlife Area Land Management Plan	Ongoing implemen-tation.	Directs habitat and species management on 3,100 acres of marsh and open water. The plan's goals are to restore and improve marsh and upland habitats for threatened and endangered species, control invasive species and allow for hunting and fishing recreation activities.	The plan has a positive effect on species of concern in the BDCP.
California Department of Fish and Wildlife	Private Lands Incentive Program		Includes 29,000 acres of habitat in Tulare Basin, Grasslands, Suisun Marsh, and Sacramento Valley. Encourages development and enhancement of habitat for shorebirds and waterfowl on private lands, and encourages wildlife-friendly farming practices.	This program has beneficial effects on waterfowl and shorebird species in the Plan Area.
California Department of Fish and Wildlife	Restoring Ecosystem Integrity in the Northwest Delta	Ongoing program.	Focused on habitat restoration. Currently concentrating acquisition efforts on 3 specific properties consisting of about 150 acres and baseline monitoring. The project centers on Calhoun Cut and Lindsay Slough in the Cache Slough ROA. The plan is designed to create a restored, protected corridor extending from Jepson Prairie to Prospect Island, doubling the overall acreage of marsh and riparian habitats, doubling the protected acres of vernal pool/perennial grasslands and increasing the abundance and local distribution of at risk and other native plant and animal species.	The program is consistent with BDCP goals for habitat restoration in the Cache Slough ROA.

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
California Department of Fish and Wildlife	Staten Island Wildlife-Friendly Farming Demonstration	Ongoing program.	Objective is ecosystem restoration; 2,500–5,000 acres of corn will be flooded to increase habitat availability and to improve wildlife-friendly agriculture to foster recovery of at-risk species and to investigate effects of agriculture on water quality.	This program is focused on improving agricultural land as seasonal habitat for greater and lesser sandhill cranes, a target species of the BDCP.
California Department of Fish and Wildlife	Yolo Bypass Wildlife Area Land Management Plan	Ongoing program.	Provides for multiple use management of 16,000 acres of mixed agricultural, grassland and managed wetland habitats. This wildlife area is managed to support wintering waterfowl populations, shorebird migration, waterfowl hunting, and active wildlife observation, especially bird watching. This is accomplished by actively managing wetland habitats and providing for wildlife-friendly farming.	
Department of Water Resources	California Water Action Plan	Initiated in January 2014.	This plan lays out a roadmap for the next 5 years for actions that would fulfill 10 key themes. In addition, the plan describes certain specific actions and projects that call for improved water management throughout the state.	
California Department of Water Resources	Central Valley Flood Protection Plan		Proposes significant expansion of flood protection features in the study area, including expansion of the Yolo Bypass.	Plan implementation could conflict with the BDCP's effort to improve giant garter snake habitat just outside of the current floodway, and to improve fish passage through Yolo Bypass waterways.
California Department of Water Resources	Delta Levees Flood Protection Program	Ongoing program.	Includes modification to Delta levees within the Sacramento-San Joaquin Delta and portions of the Suisun Marsh, with a focus on western Delta island levees. The project works with 60 reclamation districts and strives to complete levee rehabilitation projects with no net loss of habitat in the Delta.	The program has some potential to remove grassland, emergent marsh, and riparian habitats in the short-term. Habitat losses would have to be offset with protection or restoration actions.

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
California Department of Water Resources	FloodSAFE California		Promotes public safety through integrated flood management while protecting environmental resources; emphasizes action in the Delta. This program is very broad, but is designed to improve flood safety throughout the state while encouraging sound conservation actions that benefit California's native fish and wildlife and promote wildlife-friendly agricultural practices.	The program is not intended to reduce habitat values in the Delta.
California Department of Water Resources	Levee Repair-Levee Evaluation Program	Ongoing program.	Upgrading levees along the Sacramento and San Joaquin Rivers and Delta; 1,600 miles of levees included in Central Valley.	Most of the program efforts are geotechnical, bathymetric, and geomorphic evaluations that have little to no effect on terrestrial wildlife in the study area.
California Department of Water Resources and MOA Partners	Lower Yolo Restoration Project		In Cache Slough ROA, reintroduce tidal action to half of 3,408-acre Yolo Ranch. This project would eliminate existing agricultural land used primarily for grazing, and create tidal marsh for the benefit of special-status Delta anadromous and resident fish species.	The project is expected to be part of the BDCP's early implementation program. It will adversely affect some grassland species in favor of tidal marsh and riparian species.
California Department of Water Resources	Dutch Slough Tidal Marsh Restoration Project	Implementation began in 2012.	Converts 240–840 acres from agricultural uses and grazing to wetland, riparian, and upland habitats. The project also includes development of a recreation center at one end of the property.	The restoration will benefit tidal marsh and riparian habitats and species in the western Delta on lands with considerable topographic diversity and little to no land subsidence.
California Department of Water Resources, Bureau of Reclamation, Contra Costa Water District	Los Vaqueros Reservoir Expansion	Completed in 2012.	Project enlarged Los Vaqueros Reservoir to develop water supplies for environmental water management that supports fish protection, habitat management, and other environmental needs in the Delta.	

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
California High Speed Rail Authority	Sacramento to Merced Section of High Speed Rail System		One possible alignment for the section from Sacramento to Merced would includes major infrastructure construction along the I-5 corridor between French Camp and Lathrop, which would pass through the portion of the study area around the I-5 and Hwy. 120 junction. The potential alignment from the Bay Area to Stockton would cross the study area from the west near Tracy and head east to Lathrop. These alignments are within or parallel existing rail corridors.	The project has the potential to remove grassland and cultivated lands along existing rights-of-way in the study area.
California Partners in Flight	Riparian Habitat Joint Venture	Ongoing program.	Promotes and supports riparian conservation and enhancement, contributes to flood control and maximizes habitat available to wildlife. Protects and restores riparian areas with intact adjacent upland habitats.	The program has a positive influence on the value of riparian habitat.
Central Valley Joint Venture	Central Valley Joint Venture Program	Ongoing program.	Strives to protect, restore, and enhance wetlands. Contributes to habitat conservation on a total of 714,000 acres in California.	This program has the potential to convert agricultural land to managed wetland or natural wetlands.
Contra Costa County and East Contra Costa County Habitat Conservancy	East Contra Costa County HCP/NCCP	Approved in 2007. Ongoing implemen-tation.	Encompasses about 175,000 acres and contains 30,000 acres of preserved land. Purpose is to purchase, restore, and permanently protect large, interconnected and biologically rich blocks of habitat. A 63,073 acre overlap with the BDCP boundary.	This HCP/NCCP will result in restoration of native grassland, vernal pools, and oak woodland on the southwestern edge of the BDCP Plan Area.
Contra Costa Water District	Contra Costa Canal Fish Screen Project	Completed in 2011.	Designed to restore Delta ecosystems.	Minor terrestrial biological impact at fish screen sites.
Contra Costa Water District, Bureau of Reclamation, and California Department of Water Resources	Contra Costa Water District Middle River Intake and Pump Station (Alternative Intake Project)	Completed in 2010.	Resulted in permanent conversion of 6–8 acres of rural agricultural land. Features about 12,000 feet of pipe across Victoria Island and under Old River.	Permanent conversion of rural agricultural land.

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
Delta Conservancy	California EcoRestore	Initiated in 2015,	This program will accelerate and implement a suite of Delta restoration actions for up to 30,000 acres of fish and wildlife habitat by 2020.	
Delta Protection Commission	Land Use and Resource Management Plan		Outlines long-term land use requirements for the Sacramento-San Joaquin Delta. This plan directs the long-term protection of agricultural, recreational, and open space uses of the Delta and restricts urban and other types of development that would reduce the value of these uses.	The Plan supports protection and restoration of riparian and aquatic habitats in the Delta, and improvement in water quality in Delta channels.
National Marine Fisheries Service, Bureau of Reclamation, and Department of Water Resources	Biological Opinion on the Long-Term Operations of the Central Valley Project and State Water Project	Ongoing program.	Action area consists of the Oroville Reservoir, Feather River downstream of Oroville, Sacramento River downstream of Feather River, Sacramento-San Joaquin Delta, and adjacent habitats that are dependent on or influenced by waterways. Designed to conserve freshwater, estuarine, nearshore, and offshore aquatic habitats, for the benefit of federally protected fish species.	The project includes 8,000-acre tidal wetland restoration requirement, which will result in conversion of agricultural land and managed wetland in the Delta and Suisun Marsh.
Reclamation District 2093	Liberty Island Conservation Bank	Ongoing implement ation.	Permits and approvals acquired in 2009. Project site is on northern tip of Liberty Island. Over 160 acres in the project site with about 50 acres proposed to be converted to open water channels, emergent marsh wetland, and riparian habitat.	Conseervation bank focuses on Delta fish habitat but will restore 2.7 acres of riparian habitat.
Placer County Water Agency and Bureau of Reclamation	Sacramento River Water Supply Study	Study has begun.	Feasibility study under way to assess options for providing water supply to future growth in Sacramento-Placer Counties region. Includes potential new surface diversion from the Sacramento River upstream of the Delta.	

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
Sacramento Area Flood Control Agency, Central Valley Flood Protection Board, and U.S. Army Corps of Engineers	Central Valley Flood Management Program	Ongoing program.	Supports flood management planning in Sacramento and San Joaquin Valleys. To be updated every 5 years with first update to be completed in 2017. Combined total of about 2.2 million acres of land within the Central Valley. The program supports improvements in flood management structures, including levees and bypasses.	Facilities improvements could result in removal of vegetation in the study area as flood control facilities are improved and expanded.
San Joaquin Council of Governments	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan	Approved in 2011. Ongoing implemen-tation.	Includes most of San Joaquin County. Assumes 100,000 acres of open land conversion and provides about 100,000 acres of preserves. About 35% of this plan overlaps with BDCP so competition for restoration sites and land acquisition would exist. There are 39 covered species in common and very similar land acquisition targets, such as riparian forests and grasslands.	The plan is likely to result in conversion of agricultural land to native vegetation, including riparian and grassland areas in the south and east Delta.
Semi Tropic Water Storage District	Delta Wetlands	Draft EIR issued in 2010 and a Final EIR certified in 2012.	Flood storage and habitat conservation project on four Delta islands. This project could convert four large Delta islands into 11,000 acres of freshwater storage and 9,000 acres of managed agricultural lands, wetlands, riparian areas and other types of wildlife habitat.	A significant amount of agricultural land could be removed from production.
Solano County	Solano County Multispecies Habitat Conservation Plan		Establishes habitat conservation goals for Solano County, including approximately 205,000 acres of the study area. This conservation plan focuses on protection and restoration of 13,000-15,000 acres of valley floor grassland and vernal pool habitat for a range of special-status species. Many of the target species are common with the BDCP, including fairy shrimp, Swainson's hawk, western burrowing owl, giant garter snake, California red-legged frog, and Mason's lilaeopsis.	

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
U.S. Army Corps of Engineers	CALFED Levee Stability Program		Includes maintaining and improving levee stability in the Delta. Long-term strategy will include ecosystem restoration. Partially funds McCormack-Williamson Tract Restoration in Cosumnes-Mokelumne ROA. 1	The program's 500 acres of tidal and floodplain habitat restoration would expand habitats also targeted by the BDCP.
Bureau of Reclamation	Delta-Mendota Canal/California Aqueduct Intertie	Completed in April 2012.	Included construction of a pump and 500-foot pipeline between the two canals near the Jones Pumping Plant.	The majority of the habitat disturbed was nonnative annual grassland. No special-status plant community was affected.
Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Department of Water Resources, and Department of Fish and Wildlife	San Joaquin River Restoration Program	Ongoing program initiated in 2006.	150 miles of the river is planned for restoration, with an emphasis on improving fish passage and riparian habitats within and adjacent to the river's floodplain.	This program does not include lands within the BDCP Plan Area, but would provide habitat connections along the San Joaquin River upstream of the Plan Area.
Bureau of Reclamation and San Luis & Delta Mendota Water Authority	Agricultural Drainage Selenium Management Program	Under develop-ment.	San Joaquin Valley agricultural drainage control program designed to reduce agricultural-related discharges of selenium into the San Joaquin River and south Delta.	
U.S. Fish and Wildlife Service, Bureau of Reclamation, and California Department of Fish and Wildlife	San Joaquin Basin Action Plan		Includes a habitat acquisition and wetland enhancement project on 23,500 acres in northern San Joaquin River basin, outside of the BDCP Plan Area. This program is focused on supplying adequate water to state and federal refuges and managed wetlands in the San Joaquin Valley for the benefit of migratory waterfowl and other species that are supported by these managed wetlands. These habitats are elements of the larger Central Valley flyway that includes wetlands in the BDCP Plan Area	The plan benefits migratory waterfowl and other species supported by managed wetlands

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
U.S. Fish and Wildlife Service and Sacramento County	South Sacramento Habitat Conservation Plan		Establishes conservation goals for south Sacramento County, including approximately 43,000 acres of the study area. This plan targets habitat restoration and preservation for 16 species that are common to the BDCP. Habitat improvements are sought for grassland, wetland, agricultural land and riparian areas. There is overlap in the demand for land acquisition sites between the BDCP and the South Sacramento Plan. The Plan also provides for an urban expansion area within the BDCP Plan Area.	Collaborative planning for the plan and the BDCP could improve the opportunities to create a continuous band of preserved land from giant garter snake populations in the White Slough area to Stone Lakes NWR and Cosumnes River Preserve.
U.S. Fish and Wildlife Service	Recovery Plan for Sacramento-San Joaquin Delta Native Fishes	Ongoing implementation.	Released in 1995, the recovery plan includes developing additional shallow water habitat, riparian vegetation zones and tidal marsh to restore wetland habitats for the benefit of 8 native species throughout the Bay-Delta ecosystem. The objective of the plan is to establish self-sustaining populations of the species included in the plan. The goals for chinook salmon, green sturgeon, and splittail include providing for a limited harvest that can be sustained. The estuary is to be managed so that it is better habitat for aquatic life in general and for the fish species of concern in particular. This plan complements the goals of the BDCP, for both terrestrial and aquatic species in the Delta.	

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
U.S. Fish and Wildlife Service	Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan	Ongoing implemen-tation.	Directs habitat and species management on approximately 17,600 acres of grassland, agricultural land, managed wetland and riparian habitat. The managed lands of the refuge are a major conservation feature on the eastern boundary of the BDCP Plan Area. Lands within the refuge are owned in fee title or cooperatively managed with landowners through easements. The goals of the refuge are to conserve, restore and manage wetland, grassland, and riparian habitat for the benefit of fish, wildlife and plants, and special-status species; conserve enhance, and restore high quality migrating, wintering and breeding habitat for migrating birds; provide visitors with wildlife-dependent recreation, education and interpretation opportunities; and identify and protect cultural resources. The refuge represents an opportunity for cooperative habitat conservation between the USFWS and BDCP implementing entities.	
U.S. Fish and Wildlife Service, Bureau of Reclamation, and California Department of Water Resources	Biological Opinion on the Long-Term Operations of the Central Valley Project and State Water Project (delta smelt)	Ongoing program.	The opinion directs reasonable and prudent actions associated with the ongoing operation of the CVP and SWR, as they relate to the long-term survival of delta smelt. It directs actions associated with reducing entrainment of adult, juvenile and larval smelt in the south Delta pumps; improving habitat for smelt within the Delta by regulating river outflow, restoring or creating at least 8,000 acres of intertidal and related subtidal habitat for delta smelt in the Delta and Suisun Marsh; and initiating a monitoring and reporting program.	This program is a principal element in controlling west Delta and Suisun Marsh salinity levels that might affect terrestrial species and habitats.

Agency	Program/Project	Status	Description of Program/Project	Effects on Terrestrial Biological Resources
Yolo County	Yolo Natural Heritage Program Plan	First administrative draft plan released in June 2013.	Establishes habitat conservation goals for Yolo County (653,818 acres), including 111,383 acres of the BDCP study area. The principal areas of overlap are in the Yolo plan's Planning Units 17 and 18, northern and southern Yolo Bypass. This corresponds primarily with BDCP CZ 2. Thirty-two species are being considered for ESA and NCCPA coverage, including Swainson's hawk and giant garter snake. The Yolo plan proposes to restore or protect over 76,000 acres of valley oak woodland, valley foothill riparian, fresh emergent wetland, shrubland, agricultural land and grassland.	The plan provides the potential to work toward common habitat protection, restoration, and enhancement with the BDCP in the Yolo Bypass area.
Zone 7 Water Agency and Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Completed in 2012.	More than 40 miles of pipelines, a 500 acre-foot reservoir, and new pumping facilities.	Located outside of the BDCP Plan Area, the project removed grassland, riparian, and related habitats in the hills west of the Plan Area.

12.3.5.2 Cumulative Effects of the No Action Alternative

Effects of Past, Present and Reasonably Foreseeable Projects and Programs

The current conditions of study area biological resources are the byproduct of past and ongoing human activity and natural processes. The present geographic range and condition of natural communities, special-status and common plants and wildlife, and invasive species are described in Section 12.1, *Environmental Setting/Affected Environment*. A brief synopsis of general environmental conditions and their evolution in the study area is presented in Section 12.1.1, *Historical Trends in Biodiversity of the Plan Area*. This discussion provides a context of gradually declining acreages of natural habitat due to agricultural, urban development, flood control and water management activities.

The various projects and programs listed in Table 12-8 will have cumulative effects on the existing biological resources of the study area through the early long-term (year 15) and over the next 50 years. The most relevant elements of these projects and programs are their ability to modify land use patterns, modify land management practices, and change the patterns of hydrology and vegetation in the study area. Most of the local, state and federal land use and land management programs that are affecting or will affect the Delta are designed to preserve open space and agricultural lands, and to manage the resources of the area for multiple uses, including agriculture, recreation, fish and wildlife habitat, flood protection and water management. The restoration programs will increase primarily wetland and riparian natural communities by converting agricultural land or managed wetland. The special-status and common plants and wildlife that rely on wetland and riparian habitats for some stage of their life will benefit from these changes over time. Other species that rely on agricultural land and managed wetland, but do not benefit from wetland and riparian expansion, may decline in the study area. On the upland fringes of the Delta, plans exist for small expansions of urban development that would remove primarily agricultural land uses. The management of state- and federally owned wildlife areas, including Grizzly Island, Sherman Island and Yolo Bypass State Wildlife Areas and Stone Lakes NWR, will continue to focus on multiple uses, including wildlife habitat improvement, public access for wildlife viewing, wildlife-friendly agricultural production, and hunting opportunities. Natural habitat will be improved and expanded. The principal changes that are likely to result from the various habitat conservation plans that overlap with the study area would be expected to include the restoration and protection of the habitats that support the same special-status species being addressed in the BDCP (see *Effects of Other BDCP Conservation Measures on Overlapping Conservation Plans*, below). These changes would be expected to result in increases of wetland, grassland and riparian habitats, and a decrease in agricultural lands, and possibly managed wetlands in the study area.

Implementation of the water management strategies associated with the programs listed in Table 12-8 would not significantly modify the principal natural communities in the study area. These management strategies are designed, in part, to improve aquatic habitat conditions in the Delta for the benefit of special-status fish species. Periodic levee and channel maintenance activities associated with the flood management programs in Table 12-8 would result in localized disturbances to valley/foothill riparian, grassland, and tidal perennial aquatic natural communities, and to a lesser extent to tidal brackish and tidal freshwater emergent wetlands. To the extent that ongoing levee repair and replacement involves use of reinforcing rock and discouragement of replanting streamside vegetation, there could be a gradual decline in the extent and value of valley/foothill riparian habitat and grassland along minor and major waterways. Several of the water management and transportation projects listed in Table 12-8 require localized removal of natural communities and agricultural land for expanding infrastructure. Most of these activities are on the periphery or just outside of the study area, including the Contra Costa Water District fish screen and diversion structure modifications, the Delta Mendota Canal/California Aqueduct intertie project, the South Bay Aqueduct improvement project, and California High Speed Rail.

Even though the ELT period is significantly reduced from the No Action Alternative (LLT) time period, the overall direction of these existing and ongoing programs and policies that influence land conversion and land management in the study area would continue to be toward maintaining the mix of agricultural, recreational, water management, and wildlife uses in the Delta, Yolo Bypass, and Suisun Marsh. Some actions that will occur under the No Action Alternative (ELT) will expand natural and manmade terrestrial and wetland habitats that will benefit the special-status and common plants and wildlife with expanded and enhanced habitat in the study area. The potential will remain, however, for long-term trends in levee deterioration, global climate change, and seismic activity that could damage levees and result in significant changes in natural communities and cultivated lands.

Effects of Global Climate Change

As discussed in Chapter 29, *Climate Change*, global climate change is expected to result in many physical changes to the BDCP Plan Area. From a terrestrial biology perspective, the most significant changes would include a gradual rise in sea level, increasing water and air temperatures, more frequent drought and extreme rainfall events, and changes in the hydrologic patterns of the rivers and the Delta channels that influence the terrestrial and aquatic habitats used by terrestrial plants and wildlife. The BDCP climate change analysis included in Chapter 29 considers sea level increases at various levels, including 18–55 inches during the Plan period (see Chapter 29, Section 29.3.1). Air temperatures are projected to rise by 2–5 degrees F by 2050 and water temperatures are projected to increase as some proportion (2–3 degrees F) of the air temperature rise (see Appendix 29C, Section 29C.2.1). The changed frequency of drought and extreme rainfall events has not been predicted, but these events are expected to be part of future California conditions with global climate change. Hydrologic conditions in the rivers and Delta channels are expected to be altered by changes in precipitation patterns, with a portion of precipitation shifting from snow to rainfall in the winter months. This would increase river flows in winter and early spring, and decrease flows in the remainder of the year as snowmelt runoff decreases. The changes in river flows would generate subsequent changes in west Delta and Suisun Marsh salinity levels.

The physical changes in conditions in the study area related to the climate change described above, especially the sea level rise, could change the distribution and value of study area habitats. The sea level rise is expected to gradually inundate existing habitats on the periphery of the Delta, in the lower Yolo Bypass, and the northern and southern edges of Suisun Marsh. This pattern of inundation, which assumes a 55-inch sea level rise, is shown in Figure 29-1. Projected sea level rise by around the early long term (2025) would range between 1.7 and 11.7 inches (see Table 29-2 in Chapter 29, *Climate Change*). Tidal brackish and freshwater marsh could be gradually inundated and converted to more subtidal habitat. In areas where there is no upland barrier (e.g., levees, roads, residential development, agricultural fields), some portion of the tidal marsh may re-establish upslope with the higher water levels if there is sufficient sediment available to provide an appropriate substrate. However, decreases in sediment availability that have occurred in the Delta and Suisun Marsh over time and that may continue may not keep pace if the higher estimated rates of sea level rise occur (Barnard et al. 2013). The result could be a gradual loss of these tidal marshes. Where barriers exist upslope of existing marsh, the tidal marsh habitat could be gradually inundated and subtidal areas would remain. Subtidal habitat is less valuable to the special-status and common terrestrial plants and wildlife of the study area. Low-lying upland grassland and riparian areas that border the study area waterways could also be gradually converted to tidal marsh, but would be expected to re-establish upslope where open ground exists and there are no physical barriers. Where these deeper water incursions bisect existing wildlife corridors, the ability of certain species to move and interact with adjacent populations would decrease. Population numbers of riparian, grassland, and tidal marsh species would be likely to decrease and population distribution would be altered. The habitats adjacent to study area waterways would also be exposed to more frequent inundation and desiccation as precipitation levels show greater fluctuation.

Land subsidence, sea level rise, gradual or catastrophic levee failure, or a combination of these conditions, should they occur, would result in flooding and inundation that could significantly damage existing facilities and infrastructure, uproot and kill vegetation to an unknown extent, permanently flood Delta islands, and drastically alter the salinity of Delta waterways and wetlands. Depending on the extent and duration of flooding, significant short- and long-term changes could occur in the availability of shallow tidal wetlands, riparian and grassland habitats and managed lands useful to certain special-status and common species (e.g., cultivated lands, managed wetland). Depending on the amount of human intervention to drain islands and rebuild levees, there may be a gradual succession of habitats less valuable to the plant and animal species currently relying on the Delta for growth and seed production, cover, breeding, nesting, resting, movement corridors and foraging. Refer to Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water*

Supplies, for a further discussion of seismic and climate change effects that might occur in the study area under the no action condition. While similar risks would occur under implementation of the action alternatives, these risks may be reduced by BDCP-related levee improvements, along with implementation of those projects identified for the purposes of flood protection in Table 12-8.

The negative elements of global climate change described above would be a contributing factor to any cumulative effects of implementing the projects and programs that are part of the No Action scenario (Table 12-8). Any negative effects on terrestrial biological resources associated with the action alternatives (see below), when considered with all of the above effects of the No Action Alternative, could create adverse cumulative effects to these terrestrial biological resources.

12.3.5.3 Concurrent Project Effects

The terrestrial biological resources impact analyses for the BDCP alternatives contains separate sections for effects on 12 different natural communities, on cultivated land, and on 149 special-status wildlife and plant species. For each of these resources, the first impact discussion presented (e.g., *Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog*) is structured to provide a concurrent analysis of the effects of CM1 and CM2–CM11, and CM18 during the near-term time frame (the period in which CM1 would be constructed) and provides NEPA and CEQA conclusions for the near-term as well as the late long-term time periods of the Plan. The near-term analysis includes individual discussions of each Conservation Measure's contribution to the effect. For many of the natural communities and associated habitats for the special-status species, the near-term construction of CM1 and the conversion of lands for restoration would jointly reduce the acreages of essential habitat at locations scattered throughout the Plan Area. To avoid a substantial short-term loss of essential habitat during the near-term period, many of the habitat protection and restoration actions (CM3, CM4, CM6, CM7, CM8, CM9, CM10, and CM11) would include early implementation schedules to allow habitat protection and habitat creation to keep pace with the gradual losses that would occur. The goal would be to avoid and minimize temporal losses in habitat acreage and value that could limit the range or reduce the long-term viability of the Plan Area's sensitive biological resources.

Each of the BDCP alternatives would provide sufficient habitat protection and restoration acreage in the near-term to keep pace with habitat losses by including CMs and AMMs to avoid significant impacts, with small exceptions. The impacts on vernal pool habitat and its associated special-status vernal pool crustaceans generated by construction of CM1 for Alternatives 1C, 2C, and 6C (the western canal alignment) would require mitigation in the form of increasing the amount of vernal pool complex habitat to avoid significant impacts. Also, the construction of the extensive, linear CM1 canals for Alternatives 1B, 1C, 2B, 2C, 6B, and 6C would contribute to a significant and unavoidable cumulative effect on wildlife movement corridors across the Sacramento-San Joaquin Delta. CM1 construction for Alternatives 1B, 2B, and 6B would also create a significant and unavoidable cumulative impact by creating barriers to the movement and population connectivity of giant garter snakes in the western portion of the Plan Area.

The analyses for Alternatives 4A, 2D, and 5A address both the effects of constructing the water conveyance facilities and implementing the Environmental Commitments concurrently (restoration, enhancement, and protection), and the NEPA and CEQA conclusions are based on the overall effects of both the water facilities and the Environmental Commitments.

12.3.5.4 Cumulative Effects of the Action Alternatives

This cumulative analysis discusses both the BDCP alternatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) and the non-HCP Alternatives (4A, 2D, and 5A).

BDCP Alternatives

Based on the analyses presented in earlier parts of this chapter, the alternatives would have little or no negative effect on nearly all of the terrestrial biological resources of concern in the study area. For the BDCP alternatives, this is consistent with the goal of HCP/NCCP programs, which is to improve the long-term viability of special-status species and their habitats. The positive effects of implementing the BDCP are similar in all of the project alternatives other than the No Action Alternative. There are relatively small variations in the acres affected by construction of the alternative water conveyance facilities (CM1), but the restoration, protection, enhancement and stressor reduction elements of the alternatives are the same for Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 6A, 6B, 6C, 8 and 9. These elements of the BDCP have the greatest potential to modify natural communities and affect special-status plants and wildlife. There are reductions in tidal marsh restoration (CM4) associated with Alternative 5, and expansion of channel margin habitat enhancement (CM6) and floodplain restoration (CM5) associated with Alternative 7 that create significant variances from the rest of the alternatives. Where relevant, these differences are addressed in the impact analysis that follows.

While construction and restoration activities in the near-term period of the alternatives would temporarily or permanently remove natural communities and modeled habitat for special-status plant and wildlife species, the near-, mid- and long-term conservation actions would replace, enhance and in most cases expand habitat acres and value for these species. The positive effects the alternatives would have on special-status species would also provide benefits to common terrestrial wildlife and plants.

The potential adverse effects of implementing all of the BDCP alternatives include potential disturbance of nesting colonies of bank swallows, should they be present adjacent to construction activity at the north end of the Yolo Bypass, and the potential that BDCP-related changes in river stage upstream of the study area on the Sacramento and Feather Rivers could adversely affect bank swallow colonies. Though the alternatives using the east (Alternatives 1B, 2B, and 6B) and west (Alternatives 1C, 2C, and 6C) alignments would provide the same conservation benefits as the other alternatives, the construction of the canal portions of the conveyance facilities would create substantial barriers to wildlife movement within and through the study area. Also, the canal associated with the east alignment alternatives (1B, 2B, and 6B) would adversely affect movement and connectivity between subpopulations of giant garter snake in the vicinity of White Slough in the eastern Delta.

Because these are the only potential adverse effects that could combine with the projects and programs in Table 12-8 and with global climate change to create a cumulatively considerable effect, the discussion that follows is limited to these issues.

Non-HCP Alternatives

For Alternatives 4A, 2D, and 5A, the Environmental Commitments, resource guidelines, AMMs, and mitigation measures presented are sufficient to avoid significant cumulative effects from the combined losses due to water conveyance construction and restoration except for upstream effects on bank swallows (see Impact BIO-189: *Cumulative Upstream Effects of Reservoir and Water Conveyance Facilities Operations on Bank Swallow*).

Impact BIO-188: Cumulative Indirect Effects of the Construction of Conservation Components on Bank Swallow

Noise and visual disturbances during restoration activities for all action alternatives could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas, and construction-related disturbances could result in an adverse effect on individuals. The noise and visual disturbance could result from implementing *CM2 Yolo Bypass Fisheries Enhancement*, and *CM4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites. Bank swallow colonies with occupied burrows have been recorded in CZ 2 and CZ 5. Various activities related to *CM11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow. Alternatives 4A, 2D, and 5A would not include the CM2 (Yolo Bypass) restoration activities, so they would not create the potential noise and visual disturbances that could affect bank swallow in CZ 2.

Other projects and programs listed in Table 12-8 also have the potential to directly or indirectly affect bank swallow in the study area and in areas upstream of the study area along the Sacramento and Feather Rivers.

- DWR Central Valley Flood Protection Plan (Yolo Bypass widening).
- DWR Delta Levees Flood Protection Program.
- DWR FloodSAFE California.
- Sacramento Area Flood Control Agency, Central Valley Flood Protection Board, and USACE Central Valley Flood Management Program.
- UUSACE CALFED Levee Stability Program.
- Reclamation and Placer County Water Agency Sacramento River Water Supply Study

All of the flood control and levee protection programs and plans listed above could involve modification and armoring of levees within the range of known bank swallow colonies adjacent to and north of the study area. Additional bank protection could further reduce the availability of bank swallow nesting sites and could involve indirect disturbance of active nesting colonies. The action alternatives, in combination with the other projects and programs listed above, could result in adverse effects on bank swallow nesting colonies that are individually limited but cumulatively considerable.

***NEPA Effects*:** The indirect disturbance to bank swallow nesting colonies caused by implementing any action alternative, in combination with the potential direct and indirect effects on these colonies caused by other past, present, or reasonably foreseeable projects and programs, would create an adverse cumulative effect on this species adjacent to and north of the study area. The disturbances could result in take of a state-listed threatened species. Although the potential effect of the alternatives is restricted to few colonies, the state recognizes this species as both imperiled and vulnerable because of its restricted range and low populations. Therefore, the effect of the alternatives represents an adverse cumulative effect. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this effect.

***CEQA Conclusion*:** The indirect disturbance to bank swallow nesting colonies caused by implementing any action alternative, in combination with the potential direct and indirect effects on these colonies caused by other past, present or reasonably foreseeable projects and programs, would create a significant cumulative impact on this species adjacent to and north of the study area. The disturbances could result in take of a state-listed threatened species. Although the potential cumulative effect is restricted to a single colony, the state recognizes this species as both imperiled and vulnerable because of its restricted range and low populations. The contribution of action alternatives to this cumulative impact is considered cumulatively considerable because construction of these alternatives related to the Yolo Bypass could indirectly affect this species. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact less than cumulatively considerable.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, project proponents will not conduct restoration activities during the bank swallow nesting season (April 1 through August 31). If construction activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, project proponents will establish a nondisturbance buffer (determined in coordination with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-189: Cumulative Upstream Effects of Reservoir and Water Conveyance Facilities Operations on Bank Swallow

One the primary threats to bank swallows is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs between April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the March when the swallows have nested and laid eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses which resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel Thermalito Dam, and Feather River at the Confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, critical years, and an average (see Chapter 5, Section 5.3.1, *Methods for Analysis*, for a description of the model).

On the Sacramento River, at the Keswick and Red Bluff gauges, mean monthly flows under the action alternatives 1–9 and potentially other cumulative projects would increase between April and August in some water years which could lead to inundation of active colonies. However, the flows under Existing Conditions and the predicted flows in the late long-term without the project also show increases in flows during the breeding season (April–August) in these water year types. Similar trends occur for the Feather River. In addition, under the action alternatives flows are predicted to be greater than 14,000 cfs during the breeding season (April–August,) during certain water years which could lead to bank collapse. However, flows of this height are recorded under Existing Conditions at this flow gauge and are also predicted for the late long-term time without the project (the No Action Alternative).

NEPA Effects: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under the action alternatives would not be substantially greater than under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow. Because the state recognizes this species as both imperiled and vulnerable due to its restricted range and low populations, any negative effect of the alternatives would represent a cumulatively considerable contribution to an adverse cumulative effect.

CEQA Conclusion: High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under the action alternatives would not be substantially greater than under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of upstream impacts on bank swallow from changes in operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area* would address this significant impact and further determine if additional mitigation is required for bank swallow. Because the state recognizes this species as both imperiled and vulnerable due to its restricted range and low populations, any adverse impact of the alternatives would represent a cumulatively considerable contribution to a significant cumulative impact.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will monitor existing colonies upstream of the study area and collect habitat suitability data including soil type, number of active burrows per colony, and height of average burrows. DWR will quantify the magnitude of spring flows that would result in potential mortality of active colonies. In addition, to determine the degree to which reduced winter flows are contributing to habitat loss, DWR will quantify the winter flows required for river meander to create suitable habitat through lateral channel migration and bank resurfacing. If impacts of upstream flows on bank swallow are identified, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Impact BIO-190: Cumulative Effect of Constructing Conveyance Facilities on Giant Garter Snake Movements and Connectivity between Subpopulations

The construction of the conveyance facilities under the alternatives using the eastern alignments (Alternatives 1B, 2B, and 6B) would adversely affect movement and connectivity for the Coldani Marsh/White Slough subpopulation of giant garter in the study area. The facilities would eliminate Coldani Marsh/White Slough subpopulation connectivity with areas containing current or previous occurrences of giant garter snake, specifically in the vicinity of Stone Lakes NWR to the north and in the Delta to the southwest (Figure 12-15B). An unknown number of small agricultural ditches and drains between Disappointment Slough and Stone Lakes would be lost, rerouted, or directed into culverts and affect species' movements and connectivity. Siphons would be constructed underneath sloughs (Disappointment Slough, White Slough, Sycamore Slough, Hog Slough, and Beaver Slough) and Stone Lakes Drain, and a tunnel would be constructed under the Lost Slough/Mokelumne River area that connects with Snodgrass Slough. These sloughs and drains would still provide some aquatic habitat and opportunities for movement and connectivity between giant garter snakes in the vicinity of Stone Lakes NWR and the Coldani Marsh/White Slough subpopulation.

Other factors, projects, or programs also have the potential to directly or indirectly affect giant garter snake movements and connectivity in the study area.

- Urbanization continues to be one of the greatest threats to the giant garter snake throughout much of its extant range. Environmental impacts associated with urbanization are loss of habitat, introduction of nonnative species with a resulting loss of biodiversity, fragmentation of habitat due to road construction, and degradation of habitat due to pollutants. Within the current range of the giant garter snake, cities that are rapidly expanding and, in some instances, intruding upon or otherwise impacting giant garter snake habitat include, Chico, Woodland, Yuba City, Marysville, Sacramento, Galt, Stockton, Gustine, Los Banos, Merced, and Fresno. Urbanization increasingly threatens the viability of giant garter snake populations as urban landscapes encroach on ever-diminishing habitat for this listed species, including eliminating rice agriculture that serves as an alternative habitat for the giant garter snake.
- A number of HCPs have been issued by USFWS for projects anticipated to impact the giant garter snake, which include the San Joaquin County multi-species HCP, the East Contra Costa County HCP, and the PG&E San Joaquin Valley HCP. In addition, eight other HCPs that include areas within the range of the giant garter snake are currently being developed: Butte County, South

Sacramento, Solano County, Yolo County, Yuba/Sutter County, Placer County, PG&E Statewide Operations and Maintenance, and PG&E Bay Area.

- Giant garter snakes found in rice fields or agricultural canals are threatened by conversion of rice crops to non-agricultural land uses and other crops such as grape-producing vineyards, fruit or nut producing orchards, or annual row crops (e.g., cotton). Unlike flood irrigated rice fields, other agricultural cropping systems do not hold sufficient water for long enough time periods to create artificial, temporary wetlands.

- The White Slough Wildlife Area (WSWA) is owned by DWR and managed by CDFW. WSWA consists of 880 acres of man-made ditches, canals, and freshwater marshes with associated grassland/upland habitats used for hunting and fishing. From 1974 to 1978, 13 rectangular borrow pits were excavated from 1 to 5 miles west of I-5 to provide fill for freeway construction. The pits are fed by groundwater and periodic runoff from precipitation, irrigation, and high canal flows, creating a series of ponds characterized by vegetated sloping or vertical banks and open water with adjacent uplands and high ground. As a management area, WSWA comprises a discontinuous series of properties encompassing ponds 5–13, which occur along a roughly 11-mile stretch between Thornton and Stockton. WSWA supports the preponderance of the Coldani Marsh/ White Slough giant garter snake population, one of 13 giant garter snake populations described in the USFWS 1999 *Draft Recovery Plan for the Giant Garter Snake*. In the 1970s, CDFW stocked large-mouth bass, channel catfish, and red-eared sunfish in at least two of the ponds: each of these species probably prey on giant garter snakes and compete with them for smaller prey (58 FR 54053).

- DWR Central Valley Flood Protection Plan (Yolo Bypass widening) proposes expansion of flood protection features in the study, including expansion of the Yolo Bypass. This flood protection improvement project would potentially conflict with BDCP's effort to improve giant garter snake habitat just outside of the current floodway.

- The NMFS, Reclamation and DWR BiOp on the long-term pperations of the CVP and SWP includes the Sacramento River downstream of Feather River, Sacramento-San Joaquin Delta, and adjacent habitats that are dependent on or influenced by waterways. The BiOp includes landscape designs to conserve freshwater, estuarine, nearshore, and offshore aquatic habitats, for the benefit of federally protected fish species. Including 8,000-acre tidal wetland restoration requirement, which would result in conversion of agricultural land and managed wetland in the Delta and Suisun Marsh, which could negatively affect giant garter snake connectivity and movement in the study area.

- Sacramento Area Flood Control Agency, Central Valley Flood Protection Board, and USACE Central Valley Flood Management Program is an ongoing program that supports flood management planning in Sacramento and San Joaquin Valleys. The program supports improvements in flood management structures, including levees and bypasses. Facilities improvements could result in local removal of vegetation in the study area as flood control facilities are improved and expanded which could include effects on giant garter snakes in the study area.

Past development within the study area, including urbanization and the construction of irrigation canals, levees, local roads, highways, agricultural development, and the development of wildlife management areas, has already affected the ability for giant garter snake to move within and through the study area.

NEPA Effects: The construction of the water conveyance facilities under Alternatives 1B, 2B, and 6B, in combination with past, present or reasonably foreseeable projects would create an adverse cumulative effect on giant garter snake movement and connectivity within and in the vicinity of the study area. The alternatives' effects represent a cumulatively considerable contribution to an adverse cumulative effect. The only ways to reduce the effects these alternatives would have on giant garter snake movement would be to eliminate the canals from these alternatives, which cannot be done because the canals are essential components of these alternatives, or to create numerous overpass structures along the canals, which would substantially increase the costs and would not fully address the habitat connectivity and movement needs of giant garter snake. For these reasons, there is no feasible mitigation to address this effect.

CEQA Conclusion: The construction of the water conveyance facilities under Alternatives 1B, 2B, and 6B, in combination with past, present or reasonably foreseeable projects would create a significant cumulative impact on giant garter snake movement and connectivity within and in the vicinity of the study area. The alternatives' impact would represent a cumulatively considerable contribution to a significant cumulative impact. This impact would be significant and unavoidable. The only ways to reduce the effects these alternatives would have on giant garter snake would be to eliminate the canals from these alternatives, which cannot be done because the canals are essential components of these alternatives, or to create numerous overpass structures along the canals, which would substantially increase the costs and would not fully address the habitat connectivity and movement needs of giant garter snake. For these reasons there is no feasible mitigation to reduce this impact to a less-than-significant level.

Impact BIO-191: Cumulative Effect of Constructing Conveyance Facilities on Wildlife Corridors

The construction of the water conveyance facilities (CM1) under the alternatives using the eastern alignment (Alternatives 1B, 2B, and 6B) and western alignment (Alternatives 1C, 2C, and 6C) would adversely affect wildlife corridors within and through the study area. The intakes, forebays, and canal portions of these alternatives would create barriers to the movement of nonavian wildlife within and through the study area. Nonavian wildlife in large portions of the study area would be restricted to moving across the canals via roads and bridges that would likely act as deterrents to wildlife movement and would be a source of wildlife mortality. The canal for the eastern alignment would act as a major barrier to the movement of nonavian wildlife within the eastern portion of the Delta. The canals for the western alignment would create a substantial barrier to the east-west movement of nonavian wildlife from Clifton Court Forebay north to around the community of Knightsen, and to the north-south movement of wildlife from the town of Hood west to the Sacramento Deep Water Ship Channel. Avian species would also be subject to increased mortality where new transmission lines are installed; however, these lines would not serve as major barriers to avian species' ability to disperse within and through the study area.

One project listed in Table 12-8, the California High-Speed Rail, would also have the potential to adversely affect wildlife corridors in the study area and region. One of the proposed alignments for the Sacramento-to-Merced section of the California High Speed Rail would pass through the study area between French Camp and Lathrop, generally following the I-5 corridor and eventually heading east along State Route 120. A proposed option for the Bay Area-to-Central Valley alignment passes through the study area from just west of Tracy east to around Lathrop, a route that generally follows the existing Union Pacific Rail Road corridor. Both of these areas already have barriers to species dispersal, but increased rail traffic and the speed of the trains could serve as deterrents and sources of mortality to wildlife trying to cross these areas.

Past development within the study area, including the construction of irrigation canals, levees, local roads, highways, and agricultural development, has already affected the ability for wildlife to move within and through the study area.

NEPA Effects: The construction of the water conveyance facilities under Alternatives 1B, 1C, 2B, 2C, 6B, and 6C, in combination with past, present or reasonably foreseeable projects, would create an adverse cumulative effect on wildlife corridors within and in the vicinity of the study area. The alternatives' effects represent a cumulatively considerable contribution to an adverse cumulative effect. The only ways to reduce the effects these alternatives would have on wildlife corridors would be to eliminate the canals from these alternatives, which cannot be done because the canals are essential components of these alternatives, or to create numerous overpass structures along the canals, which would substantially increase the costs and would not fully address all of the movement needs of the wildlife being considered (e.g., giant garter snake). For these reasons, there is no feasible mitigation to address this effect.

CEQA Conclusion: The construction of the water conveyance facilities under Alternatives 1B, 1C, 2B, 2C, 6B, and 6C, in combination with past, present or reasonably foreseeable projects, would create a significant cumulative impact on wildlife corridors within and in the vicinity of the study area. The alternatives' impact would represent a cumulatively considerable contribution to a significant cumulative impact. This impact would be significant and unavoidable. The only ways to reduce the effects these alternatives would have on wildlife corridors would be to eliminate the canals from these alternatives, which cannot be done because the canals are essential components of these alternatives, or to create numerous overpass structures along the canals, which would substantially increase the costs and would not fully address all of the movement needs of the wildlife being considered (e.g., giant garter snake). For these reasons, there is no feasible mitigation to reduce this impact to a less-than-significant level

12.3.6 Effects on Other Conservation Plans

Impact BIO-192: Potential for Conflicts between Implementation of the BDCP and Other Conservation Plans

To comply with CEQA, potential conflicts with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan must be analyzed. Within or near the study area, numerous HCPs, NCCPs, and other regional conservation plans have been permitted or are in process, including those listed below.

- Placer County Conservation Plan (TRA Environmental Services 2011)
- Yuba-Sutter HCP/NCCP (Yuba County et al. 2011)
- Natomas Basin HCP (City of Sacramento et al. 2003)
- Yolo Natural Heritage Program (YNHP) (Yolo County Habitat/Natural Community Conservation Plan Joint Powers Authority 2013)
- South Sacramento HCP (Sacramento County 2010)
- Solano County Multispecies HCP (Solano County MSHCP) (Solano County Water Agency 2009)

- East Contra Costa County HCP/NCCP (ECCCHCP/NCCP) (East Contra Costa Habitat Conservation Plan Association 2006)
- San Joaquin County Multi-Species HCP and Open Space Plan (SJCMSHCP) (Jones & Stokes 2000)
- East Alameda County Conservation Strategy (EACCS) (East Alameda County Conservation Strategy Steering Committee 2010)

Of these, the first three plans have little (less than 1%) or no physical overlap with the study area boundary and, thus, no potential for conflict with BDCP actions (Figure 12-3). The Placer County Conservation Plan is found in western Placer County and does not overlap with BDCP. The Yuba-Sutter HCP/NCCP covers Yuba and Sutter Counties and overlaps with less than 200 acres of the study area at the northern end of the Yolo Bypass (Table 12-9). The Natomas Basin HCP is found in northwestern Sacramento and southern Sutter Counties. This plan is adjacent to the study area but does not overlap with it. Because of the lack of overlap and the location of these plans upstream of BDCP, they are not discussed further in this section.

The remaining six plans overlap with the study area to varying extents (Table 12-9). Each of these six plans includes a conservation strategy that implements land restoration, enhancement and/or acquisition within or near their respective boundaries. The following discussion addresses whether the implementation of BDCP covered activities and conservation actions have the potential to conflict with these plans and their conservation strategies.

Table 12-9. Summary Table of Conservation Plans that Overlap with BDCP

Conservation Plan	Plan Status	Plan Area (ac)	Boundary Overlap with BDCP (ac)	Overlap Relative to Other Plans	Overlap relative to BDCP
East Contra Costa County HCP/NCCP	Approved in 2007	174,116	63,073	36.2%	7.3%
San Joaquin County MSHCP and Open Space Plan	Approved in 2001	912,386	317,355	34.8%	37.0%
East Alameda County Conservation Strategy	Approved in 2011	271,486	4,643	1.7%	0.5%
Solano County MSHCP	In Process	581,874	198,149	34.1 %	22.9%
South Sacramento HCP	In Process	374,733	41,130	11.0%	4.8%
Yolo Natural Heritage Program	In Process	653,818	111,383	17.1%	12.9%
Yuba-Sutter HCP/NCCP	In Process	469,137	198	0.04%	0.02%

Sources: ICF International 2011; Cal-Atlas Geospatial Clearinghouse; TRA Environmental Services 2011; Solano County Water Agency 2009; Radmacher pers. comm.

Table 12-10 lists the amount of conservation remaining in each of the three approved plans based on summary reports released in 2011. Because EACCS was just approved in 2011, no land has been acquired to date for its reserve system. The acreage provided in Table 12-10 is the estimated amount needed for the entire plan area under each plan, and is not limited to the overlap area.

Table 12-10. Conservation Status of Approved Plans (acres)

Plan	Target Reserve System Size	Current Reserve System Size	Amount Remaining to Acquire
East Contra Costa County HCP/NCCP*	30,300	4,589	25,711
San Joaquin County MSHCP**	100,841	8,942	91,899
East Alameda County Conservation Strategy***	N/A	0	N/A

Sources: ICF International 2011; San Joaquin Council of Governments 2010.

* Reserve System Size based on Maximum Development Scenario

** Based on estimated acreage of take according to mitigation ratios. Actual amount remaining likely to be much less.

*** Conservation Strategy is implemented project-by-project according to established mitigation ratios. Because the strategy is not dependent on a certain amount of development occurring, there is no target reserve system size.

Effects of Water Conveyance Facilities Construction on Other Conservation Plans

The BDCP conservation measures, or Environmental Commitments under the non-HCP alternatives, that have the potential to affect overlapping conservation plans include the construction and operation of new water conveyance facilities associated with the SWP and CVP, and the implementation of restoration and acquisition actions and other conservation activities. The effects of restoration, acquisition, and other conservation activities are discussed in the next section. To quantify the potential effects of the construction of the water conveyance facilities on overlapping plans, the permanent surface impacts of the construction of Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 2D, 3, 4, 4A, 5, 5A, 6A, 6B, 6C, 7, 8, and 9 were identified.

Construction of the water conveyance facilities would result in permanent surface disturbance within the Plan Area. Depending upon the alternative, a portion of these impacts would occur outside of the plan area boundaries for the six overlapping plans (Figure 12-4). The remaining impacts would be small relative to the size of the overlapping plan areas, varying from less than 0.01% of total plan areas, to a maximum of 2.7% of the East Contra Costa County HCP/NCCP area under Alternatives 1C, 2C, and 6C (4,755 acres of impacts within a 174,115-acre plan area). Construction of the water conveyance facilities would reduce the amount of available cultivated land for acquisition by overlapping conservation plans by as little as 5 acres in the East Alameda County Conservation Strategy (Alternatives 2D, 4, 4A, and 5A) and as much as 14,050 acres in the San Joaquin County HCP (Alternatives 1B, 2B, 6B).

The construction of the water conveyance facilities would avoid all existing reserve lands of the East Contra Costa County HCP/NCCP because these lands are outside of the study area (Figure 12-4). Similarly, construction of the water conveyance facilities using the west alignment, Modified Pipeline/Tunnel Alignment, or Pipeline/Tunnel Alignment would avoid all existing reserve lands of the San Joaquin County HCP (Figure 12-4). Construction of the east canal has the potential to temporarily affect existing preserve lands of the San Joaquin County HCP near Sycamore Slough and Walnut Grove. See the section below on this plan for details of these potential impacts and mitigation measures.

Table 12-11. Impacts from Construction of Water Conveyance Facilities under the Alternatives Relative to Total Area of Overlapping Conservation Plans

Plan	Plan Area (ac.)	Alternative	Permanent Surface Impacts (ac.)	Surface Impacts Relative to Plan (% of Plan Area)
East Alameda County Conservation Strategy	271,485	1A	228	0.08%
		1B	228	0.08%
		1C	23	0.01%
		2A	228	0.08%
		2B	228	0.08%
		2C	23	0.01%
		2D	5	<0.01%
		3	228	0.08%
		4	5	<0.01%
		4A	5	<0.01%
		5	228	0.08%
		5A	5	<0.01%
		6A	228	0.08%
		6B	228	0.08%
		6C	23	0.01%
		7	228	0.08%
		8	228	0.08%
		9	11	0.00%
East Contra Costa County HCP/NCCP	174,115	1A	1,258	0.72%
		1B	1,258	0.72%
		1C	4,755	2.73%
		2A	1,258	0.72%
		2B	1,258	0.72%
		2C	4,755	2.73%
		2D	1,823	1.05%
		3	1,258	0.72%
		4	1,823	1.05%
		4A	1,823	1.05%
		5	1,258	0.72%
		5A	1,823	1.05%
		6A	1,258	0.72%
		6B	1,258	0.72%
		6C	4,755	2.73%
		7	1,258	0.72%
		8	1,258	0.72%
		9	166	0.10%

Plan	Plan Area (ac.)	Alternative	Permanent Surface Impacts (ac.)	Surface Impacts Relative to Plan (% of Plan Area)
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan	912,383	1A	1,290	0.14%
		1B	14,044	1.54%
		2A	1,296	0.14%
		2B	14,050	1.54%
		2C	6	0.00%
		2D	1,296	0.14%
		3	1,290	0.14%
		4	1,296	0.14%
		4A	1,296	0.14%
		5	1,290	0.14%
		5A	1,296	0.14%
		6A	1,290	0.14%
		6B	14,044	1.54%
		7	1,290	0.14%
		8	1,290	0.14%
		9	2,623	0.29%
Solano County Multi-Species HCP	581,872	1C	3,165	0.54%
		2C	3,165	0.54%
		6C	3,165	0.54%
South Sacramento HCP	374,732	1A	2,105	0.56%
		1B	3,988	1.06%
		2A	2,120	0.57%
		2B	3,988	1.06%
		2D	1,455	0.39%
		3	1,933	0.52%
		4	1,013	0.27%
		4A	1,013	0.27%
		5	1,861	0.50%
		5A	823	0.22%
		6A	2,105	0.56%
		6B	3,988	1.06%
		7	1,972	0.53%
		8	1,972	0.53%
		9	150	0.04%
Yolo Natural Heritage Program Plan	653,818	1C	5,403	0.83%
		2C	5,403	0.83%
		6C	5,403	0.83%

Effects of BDCP Acquisition and Restoration on Other Conservation Plans

Like the BDCP, each of the six overlapping conservation plans contains a conservation strategy composed of a variety of actions or measures. Approved conservation plans (ECCCHCP/NCCP, SJCMSHCP, EACCS) are required to implement those actions in order to meet their permit conditions. Proposed plans (YNHP, South Sacramento HCP, and Solano County MSHCP) are not yet permitted but are far enough along in their development process to predict the nature and general location of likely conservation actions. In all overlapping conservation plans (approved or in process), the primary conservation actions are a combination of land preservation through acquisition in fee title or conservation easement and restoration of natural communities. All of the overlapping plans focus primarily on terrestrial species (see Table 1-4 in Chapter 1 of the BDCP for the overlap of covered species) and, consequently, on the preservation and restoration of terrestrial natural communities and adjacent wetland and stream systems.

This regional focus on land protection and conservation to benefit endangered species creates opportunities for coordination, partnerships, and achieving common conservation goals. However, the need to fulfill acquisition and restoration targets in geographically overlapping areas also creates the potential for conflicts. For example, in certain areas, sites available for acquisition and restoration with rare natural communities or physical conditions may be limited. This limitation may cause plans to compete for conservation lands, particularly to meet HCP obligations that are driven by mitigation-to-impact ratios.

Conservation components under Alternatives 1B, 1C, 2A, 2B, 2C, 3, 4, 6A, 6B, 6C, 8 and 9 would be the same as those under Alternative 1A. Conservation components under Alternative 5 would be the same as those under Alternative 1A, except that 25,000 acres, rather than 65,000 acres, of tidal habitat would be restored. Conservation components under Alternative 7 would be similar to those under Alternative 1A, but 40 linear miles, rather than 20 linear miles, of channel margin habitat would be enhanced, and 20,000 acres, rather than 10,000 acres, of seasonally inundated floodplain would be restored to further improve fish and wildlife habitat, particularly along the San Joaquin River.

Alternatives 4A, 2D, and 5A would not be implemented as HCP/NCCPs and would require substantially less conservation relative to the other alternatives. Tidal habitat restoration would range between 292 and 300 acres, nontidal marsh restoration would range between 832 and 1,356 acres, channel margin enhancement would range between 3.1 and 5.5 levee miles, and there would be no seasonally inundated floodplain restoration. The cultivated lands needed for protection under the non-HCP alternatives ranges between 11,301 and 13,432 acres, which is substantially less than the 48,625 acres of cultivated lands proposed for protection under the BDCP alternatives. Alternatives 4A, 2D, and 5A generally would result in the same or fewer impacts than the water conveyance facilities for the BDCP alternatives and would require substantially less restoration and protection; therefore, the analysis presented below focuses only on the BDCP alternatives, which have a greater potential for conflict with the six overlapping plans.

This analysis addresses the potential for conflict by analyzing the conservation needs of the BDCP and each of the six plans with substantial (more than 1%) overlap with the BDCP (Table 12-11).

12.3.6.1 Methodology

To understand the conservation issues of all plans relative to the overlap areas, several analyses were conducted. First, a crosswalk table was developed for all natural community types with restoration or acquisition targets in the BDCP. Because each plan uses a different land-cover dataset, a crosswalk was created that broadly assimilates these land-cover types into six categories relevant for conservation: wetlands, tidal, riparian, grassland, agriculture, and streams (Table 12-12). The BDCP dataset contains both tidal and nontidal wetlands. Tidal wetlands were assigned to the "tidal" community, while nontidal wetlands were assigned to the "wetland" community. Note that land cover types without restoration or acquisition targets in the BDCP (e.g., chaparral, urban, conifer) were not crosswalked because the analysis is limited to understanding how the implementation of BDCP restoration and acquisition targets might affect other plans.

1 **Table 12-12. Crosswalk of BDCP Natural Communities with those of Overlapping Conservation Plans**

BDCP Natural Communities		ECCC HCP/NCCP	SJCMSHCP	EACCS	Solano MSHCP	South Sacramento HCP	YNHP
Wetlands	Vernal pool complex	Perennial Wetland	Vernal Pool Grassland	Alkali Wetland	Vernal Pools	Vernal Impoundment	(riparian and wetlands)
	Alkali seasonal wetland complex	Seasonal Wetland	Wetlands	Seasonal Wetland		Vernal Pool	
	Managed wetland	Alkali Wetland		Valley Sink Scrub		Vernal Swale	
	Nontidal freshwater perennial emergent wetland					Seasonal Wetlands	
	Other natural seasonal wetland					Freshwater Marsh	
Tidal	Tidal brackish emergent wetland/ Tidal freshwater emergent wetland		Delta Water's Edge*		Coastal Marsh		
	Tidal mudflat						
	Tidal perennial aquatic						
Riparian	Valley/foothill riparian[1]	Riparian Woodland Scrub	Riparian		Riparian Vegetation	Valley Oak Riparian Woodland	(riparian and wetlands)
						Mine Tailing Riparian Woodland	
						Mixed Riparian Woodland	
						Mixed Riparian Scrub	
Agriculture	Cultivated lands	Cropland	Flooded Field		Agriculture	Cropland	
			Agricultural			Vineyard	
						Orchards	
						Irrigated Pasture-Grassland	
Grassland	Grassland	Alkali Grassland	Grassland	Alkali Meadow and Scalds	Valley Floor Grasslands	Valley Grassland	Grasslands
		Annual Grasslands		California Annual Grassland			
Dune Scrub	Inland dune scrub						
Streams	Nontidal perennial aquatic (lakes, ponds, streams)	Perennial Streams	Submerged Aquatic Vegetation	Streams			

Notes: All natural communities are crosswalked to column B NOT to each other.
Crosswalk based on aggregated Preserve Types from 2000 SJC MSCP and Open Space Plan Table 5.4.2. Each preserve includes multiple vegetation types resulting in overlaps between the preserves and the major natural community types created by the crosswalking exercise.

The six natural community categories were analyzed for each of the six plans with respect to both acquisition and restoration. Tables 12-13 through 12-17 summarize the acquisition targets for each plan, if available. In order to roughly approximate potential acquisition needs of each plan in the overlap areas, the acquisition targets from each plan for each natural community type were multiplied by the proportion of each community type in the overlap area relative to each plan as a whole. This method assumes that acquisition will be evenly distributed throughout each plan area and roughly approximates potential acquisition in the overlapping zones. In cases where acquisition was focused geographically (i.e., did not fit this assumption), a "correction factor" was applied to account for underestimates or overestimates based on plan requirements and ICF's familiarity with each overlapping plan. We used the U.S. Forest Service's California Vegetation (CALVEG) and BDCP vegetation datasets to calculate the proportion of each natural community type in the overlap areas. Because the draft conservation strategy for the YCHP has not been released, acquisition targets were not provided, only the overlap acres (Table 12-17).

Table 12-13. Estimated Overlap in Acquisition Activities by Major Natural Community Type for ECCCHCP/NCCP

	East Contra Costa County HCP/NCCP				
	Overlap with BDCP	Plan-Wide Target (acres)	Correction Factor	Estimated Acquisition Needs in BDCP Plan Area (acres)	Notes
Agriculture	96%	400	1.04	400	All agriculture acquisition will occur in BDCP overlap area.
Grassland	11%	17,750	0.5	957	Most grassland will be protected outside of the BDCP overlap area; includes alkali grassland.
Riparian	60%	70	1	42	
Wetlands	94%	336	0.4	127	Most wetlands will be preserved in foothills, not agricultural areas.

Table 12-14. Estimated Overlap in Acquisition Activities by Major Natural Community Type for San Joaquin County MSHCP and Open Space Plan

	San Joaquin County MSHCP and Open Space Plan[a]				
	Overlap with BDCP	Plan-Wide Target (acres)	Correction Factor	Estimated Acquisition Needs in BDCP Plan Area (acres)	Notes
Agriculture	40%	36,382	1	14,487	
Grassland	9%	12,744	1	1,099	
Riparian	81%	1,231	1	992	
Streams	71%	2,269	1	1,609	
Tidal	100%	6,048	0.6	3,629	Approximately half of the proposed tidal restoration would occur in the overlap area.
Wetlands	89%	701	1	624	

[a] Planwide targets based on SJC MSHCP 2010 Annual Report for remaining acquisition acres. Tidal natural community corrected due to crosswalking of Delta's Water's Edge Preserve type, which contains riparian and other vegetative types

Table 12-15. Acres of Estimated Overlap in Acquisition Activities by Major Natural Community Type for Solano County MSHCP

	Solano County MSHCP				
	Overlap with BDCP	Plan-Wide Target (acres)	Correction Factor	Estimated Acquisition Needs in BDCP Plan Area (acres)	Notes
Agriculture	29%	6,000	0.5	900	Most agricultural land will be acquired outside BDCP Plan Area to meet needs for Swainson's hawk mitigation
Grassland	19%	12,200	1	2,320	
Riparian	44%	1,050	1	462	
Tidal	84%	100	1	84	
Wetlands	94%	1,600	1	1,504	

Table 12-16. Acres of Estimated Overlap in Acquisition Activities by Major Natural Community Type for South Sacramento HCP

	South Sacramento HCP			
	Overlap with BDCP	Plan-Wide Target (acres)	Correction Factor	Estimated Acquisition Needs in BDCP Plan Area (acres)
Agriculture	21%	11,405	1	2,381
Grassland	2%	26,835	1	596
Riparian	68%	1,228	1	837
Wetlands	75%	1,996	1	1,488

Table 12-17. Overlap by Major Natural Community Type for Yolo Natural Heritage Program

	Yolo Natural Heritage Program		
	Amount in Plan Area (acres)	Overlap with BDCP (acres)	Overlap
Agriculture	365,392	72,666	20%
Grassland	100,662	10,639	11%
Riparian	6,657	3,074	46%
Streams	6,105	1,157	19%
Tidal	4,949	4,926	100%
Wetlands	11,501	10,932	95%

Effects of BDCP Acquisition of Cultivated Land on Other Conservation Plans

By far the BDCP's largest land acquisition need is for cultivated land, which the BDCP calls "cultivated lands." BDCP would acquire cultivated lands for three primary purposes. First, cultivated land would be acquired to build the water conveyance facilities, as describe above and quantified in Tables 12-18 through 12-21. Second, cultivated land would be acquired by BDCP for preservation as foraging habitat for three covered species (Swainson's hawk, sandhill crane, and tricolored blackbird). Finally, cultivated land would be acquired for restoration to tidal wetland, floodplains, riparian woodland, or nontidal marsh.

This acquisition and preservation has the greatest potential for conflict with overlapping conservation plans that have substantial needs for acquisition of cultivated lands to satisfy their own conservation requirements. Acquisition by BDCP of cultivated land reduces the amount of such land available for overlapping plans. The assessment of this potential conflict compares the amount of cultivated land not already protected (i.e., that available for acquisition) with the need for cultivated land by BDCP and each plan in the overlap area. The analysis also takes into account that BDCP and each plan would remove cultivated lands through their own covered activities, further reducing the available cultivated land for preservation. This assessment assumes all covered activities in each plan are implemented and, therefore, all mitigation or conservation needs for cultivated lands are realized in each plan. In reality, some plans may not have the development assumed by the plan and, therefore, would not have the full need assumed by the plan for mitigation or conservation (which is proportional to the development that occurs).

The cultivated preservation needs of BDCP and the other conservation plan are deemed to be without conflict if the available cultivated land with full buildout is at least double the sum of the needs of the two plans in the overlap area. This assumption is based on the need to have more cultivated land for preservation than required to ensure that enough willing sellers are available for each plan.

Table 12-18. Amount of Cultivated Land Preservation by BDCP in Each Overlap Area (Pipeline/Tunnel Alignment; Alternatives 1A, 2A, 6A)

Plan with Overlap	Amount of Unprotected Cultivated Land in Overlap Area[a] (acres)	Estimated Amount Lost to Covered Activities (acres)	Percent of Overlap of Each HCP with BDCP	Est. Amount Lost to Covered Activities in Overlap Area (acres)	Est. Amount Lost to BDCP Covered Activities in Overlap Area (acres)	Est. Preservation Need for each Plan in Overlap Area (acres)		Est. Preservation Need for BDCP in Overlap Area (acres)		Est. Cultivated Lands Available for Preservation at End of Permit Terms[e] (acres)	Total Preservation Needs in Overlap Areas (acres)		Est. Cultivated Lands Remaining After Preservation for Covered Activities and Restoration (acres)	
						Low	High	Low	High		Low	High	Low	High
East Alameda County Conservation Strategy	2,687	2,694	2%	54	78	100	1,000	100	176	2,555	100	1,176	2,455	1,380
East Contra Costa County HCP/NCCP	29,039	12,148	85%	10,326	1,140	400	400	1,460	2,562	17,573	1,860	2,562	15,713	14,611
San Joaquin County Multi-species Habitat Conservation and Open Space Plan	218,370	47,915	35%	16,770	32,580	14,487	36,382	7,400	12,987	169,090	21,887	49,369	146,203	119,721
Solano County MSHCP	59,307	60,140	34%	20,448	12,844	870	6,000	4,580	8,038	25,963	5,450	14,038	20,513	11,925
South Sacramento HCP	17,583	17,617	4.8%	846	3,556	2,381	11,405	960	1,685	12,127	3,341	13,090	8,786	(-963)
Yolo Natural Heritage Plan	55,609	47,915	17%	8,146	6,158	2,000	5,000	2,540	4,458	47,451	4,540	9,458	42,911	37,993
Total	**382,595**	**196,420**		**44,926**	**56,356**	**20,328**	**60,187**	**17,040**	**29,905**	**274,759**	**37,278**	**90,092**	**237,481**	**184,667**

[a] Estimate based on data in each plan.

Table 12-19. Amount of Cultivated Land Preservation by BDCP in Each Overlap Area (East Alignment; Alternatives 1B, 2B, and 6B)

Plan with Overlap	Amount of Unprotected Cultivated Land in Overlap Area (acres)	Estimated Amount Lost to Covered Activities (acres)	Percent of Overlap of Each HCP with BDCP	Est. Amount Lost to Covered Activities in Overlap Area (acres)	Est. Amount Lost to BDCP Covered Activities in Overlap Area (acres)	Est. Preservation Need for each Plan in Overlap Area (acres)		Est. Preservation Need for BDCP in Overlap Area (acres)		Est. Cultivated Lands Available for Preservation at End of Permit Terms (acres)	Total Preservation Needs in Overlap Areas (acres)		EST. Cultivated Lands Remaining After Preservation for Covered Activities and Restoration (Acres)	
						Low	High	Low	High		Low	High	Low	High
East Alameda County Conservation Strategy	2,687	2,694	2%	54	79	100	1,000	100	176	2,554	100	176	2,354	1,378
East Contra Costa County MSHCP	29,039	12,148	85%	10,326	1,140	400	400	1,860	2,962	17,573	1,860	2,562	15,713	14,611
San Joaquin County MSHCP	218,370	47,915	35%	16,770	44,577	14,487	36,382	7,400	12,987	157,023	21,887	49,369	135,136	107,654
Solano County Multispecies HCP	59,307	60,140	34%	20,448	12,844	870	6,000	4,580	8,038	26,015[1]	5,450	14,038	20,565	11,977
South Sacramento HCP	17,583	17,617	4.8%	846	4,024	2,381	11,405	960	1,685	12,713[1]	3,341	13,090	9,372	(-376)
Yolo Natural Heritage Program Plan	55,609	47,915	17%	8,146	6,158	2,000	5,000	2,540	4,458	41,305	2,540	4,458	36,765	31,847
Total	**382,595**	**188,429**		**56,589**	**68,822**	**20,238**	**60,187**	**20,000**	**35,100**	**257,184**	**37,278**	**90,093**	**219,906**	**167,091**

[1] This does not meet the "double the sum of the two Plans" criterion for the highest estimated preservation needs.

Table 12-20. Amount of Cultivated Land Preservation by BDCP in Each Overlap Area (West Alignment; Alternatives 1C, 2C and 6C)

Plan with Overlap	Amount of Unprotected Cultivated Land in Overlap Area (acres)	Estimated Amount Lost to Covered Activities (acres)	Percent of Overlap of Each HCP with BDCP	Est. Amount Lost to Covered Activities in Overlap Area (acres)	Est. Amount Lost to BDCP Covered Activities in Overlap Area (acres)	Est. Preservation Need for each Plan in Overlap Area (acres)		Est. Preservation Need for BDCP in Overlap Area (low) (acres)	Est. Preservation Need for BDCP in Overlap Area (high) (acres)	Est. Cultivated Lands Available for Preservation at End of Permit Terms (acres)	Total Preservation Needs in Overlap Areas (acres)		EST. Cultivated Lands Remaining After Preservation for Covered Activities and Restoration (acres)	
						Low	High	Low	High		Low	High	Low	High
East Alameda County Conservation Strategy	2,687	2,694	2%	54	0	100	1000	100	176	2,633	200	1,176	2,433	1,457
East Contra Costa County HCP/NCCP	29,039	12,148	85%	10,326	5,320	400	N/A	1,460	2,562	13,393	1,860	2,962	11,533	10,431
San Joaquin County MSHCP and Open Space Plan	218,370	47,915	35%	16,770	30,832	14,487	36,382	7,400	12,987	170,768	21,887	49,369	148,881	121,399
Solano County MSHCP	59,307	60,140	34%	20,448	16,373	870	6,000	4,580	8,038	22,486	5,450	14,038	17,036	8,448
South Sacramento HCP	17,583	17,617	4.8%	846	3	2,381	11,405	960	1,685	16,734	3,341	13,090	13,393	3,644
Yolo Natural Heritage Plan	55,609	47,915	17%	8,146	12,617	2,000	5,000	2,540	4,458	34,846	2,540	4,458	30,306	25,389
Total	**382,595**	**188,429**		**56,589**	**65,145**	**20,000**	**35,100**	**17,040**	**29,905**	**260,861**	**37,040**	**65,005**	**223,821**	**195,856**

Table 12-21. Amount of Cultivated Land Preservation by BDCP in Each Overlap Area (Through Separate Corridors Alignment; Alternative 9)

Plan with Overlap	Amount of Unprotected Cultivated Land in Overlap Area (acres)	Estimated Amount Lost to Covered Activities (acres)	Percent of overlap of Each Plan with BDCP	Est. Amount Lost to Covered Activities in Overlap Area (acres)	Est. Amount Lost to BDCP Covered Activities in Overlap Area (acres)	Est. Preservation Need for each Plan in Overlap Area (acres)		Est. Preservation Need for BDCP in Overlap Area (acres)		Est. Cultivated Lands Available for Preservation at End of Permit Terms (acres)	Total Preservation Needs in Overlap Areas (acres)		EST. Cultivated Lands Remaining After Preservation for Covered Activities and Restoration (acres)	
						Low	High	Low	High		Low	High	Low	High
East Alameda County Conservation Strategy	2,687	2,694	2%	54	8	100	1000	1,460	2,562	2,625	1,560	3,562	1,065	(-937)
East Contra Costa County HCP/NCCP	29,039	12,148	85%	10,326	257	400	400	7,400	12,987	18,456	7,800	13,387	10,656	5,069
San Joaquin County Multi-species Habitat Conservation and Open Space Plan	218,370	47,915	35%	16,770	32,841	14,487	36,382	100	176	168,759	14,587	36,558	154,172	132,201
Solano County Multispecies HCP	59,307	60,140	34%	20,448	12,844	870	6,000	4,580	8,038	26,015	5,450	14,038	20,565	11,977
South Sacramento HCP	17,583	17,617	4.8%	846	15	2,381	11,405	960	1,685	16,722	3,341	13,090	13,381	3,632
Yolo Natural Heritage Program Plan	55,609	47,915	17%	3,354	6,158	2,000	5,000	2,540	4,458	46,097	4,540	9,458	41,557	36,639
Total	**382, 595**	**188,420**		**51,797**	**52,123**	**20,138**	**60,187**	**20,000**	**35,100**	**278,675**	**37,278**	**90,093**	**241,397**	**188,582**

One limitation of this analysis is that it is a snapshot at the end of the permit terms of each plan. In reality, each plan will be gradually preserving cultivated land in the overlap area at the same time. BDCP and overlapping plans would also be coordinating and cooperating in their land acquisition activities. For example, BDCP Chapter 3, Section 3.4.1.3.1, *Land Protection*, describes a process for coordination among BDCP, South Sacramento HCP, and San Joaquin Multiple Species Conservation Plan to ensure that sufficient lands are available in the overlap area for each plan to meet its conservation obligations. Additionally, for NCCPs in development that have planning agreements, discretionary projects within the plan area that are subject to CEQA are subject to review by the CDFW to ensure that they do not conflict with the preliminary conservation objectives of an NCCP under development (Fish and Game Code Section 2810(b)(8)). Both the gradual preservation in the overlap area over time and ongoing coordination would help to minimize any conflicts that might arise with individual acquisitions or with a gradual shortage that might arise near the end of the last permit.

Tables 12-22 through 12-25 summarize the restoration targets for each plan and estimate the overlap with BDCP. The restoration targets are multiplied by the percentage of overlap between each plan area and the BDCP to approximate the potential for competition over land cover for restoration. Like the analysis for Table 12-22, a correction factor was applied to targets and plans where additional information regarding the location of restoration was available. Because the draft conservation strategy for the YNHP has not been released, a restoration table was not developed. The acres of each natural community type relative the YNHP plan area and the overlap area are provided in Table 12-17.

Table 12-22. Estimated Overlap in Restoration Activities by Major Natural Community Type for ECCCHCP/NCCP

East Contra Costa County Habitat Conservation Plan				
	Plan-Wide Target (acres)	Overlap	Correction Factor[a]	Estimated Overlap (acres)
Wetlands	315	36%	0.4	45
Riparian	55	36%	1	20

[a] Wetlands are less likely to be restored within the BDCP Plan Area because of the location of existing preserves outside of the BDCP Plan Area (wetland restoration must occur on the preserves).

Table 12-23. Estimated Overlap in Restoration Activities by Major Natural Community Type for San Joaquin County MSHCP and Open Space Plan

San Joaquin County MSHCP and Open Space Plan[a]				
	Plan-Wide Target (acres)	Overlap	Correction Factor	Estimated Overlap (acres)
Wetlands	350	35%	1	123
Riparian	751	45%	1	338

[a] Table based on remaining acres for restoration from 2011 San Joaquin County MSHCP and Open Space Plan Annual Report. Vegetation management and enhancement in other natural community types (e.g., riparian) occurring in SJC MSHCP preserves acquired under the plan. However, specific targets for this restoration is not associated with the acreages provided for plan mitigation. Riparian includes: Great Valley Riparian Forest (R), Great Valley Oak Riparian Forest (R2), Arroyo Willow Thicket (R4), Great Valley Mixed Riparian Forest (R5), Riparian Scrub (RS2), and Great Valley Riparian Scrub(S)

Table 12-24. Estimated Overlap in Restoration Activities by Major Natural Community Type for Solano County MSHCP

	Solano County MSHCP			
	Plan-Wide Target (acres)	Overlap	Correction Factor	Estimated Overlap (acres)
Wetlands	270–400	34%	1	62–92
Tidal	75–100	34%	2.94[a]	75–100
Riparian	50	34%	1	17

[a] All tidal wetland restoration is expected to occur in the overlap area.

Table 12-25. Estimated Overlap in Restoration Activities by Major Natural Community Type for South Sacramento HCP

	South Sacramento HCP			
	Plan-Wide Target (acres)	Overlap	Correction Factor	Estimated Overlap (acres)
Wetlands	722	11%	1	79
Riparian	315	11%	1	35

Note that for Tables 12-13 through 12-25, if a plan did not set an acquisition or restoration target for a given natural community type, that community type was not included in the table.

Plan-Specific Analysis

East Contra Costa County

The ECCCHCP/NCCP was adopted in 2006 by Contra Costa County and the cities of Brentwood, Clayton, Pittsburg, and Oakley. Permits were issued in 2007 by USFWS and CDFW for a 30-year term. A joint powers authority of the agencies receiving the permits and the East Bay Regional Park District formed the East Contra Costa County Habitat Conservancy to implement the plan.

The HCP/NCCP provides regional conservation while improving and streamlining the permit process for endangered species. In 2012, the Corps issued a Regional General Permit to the East Contra Costa County Habitat Conservancy to provide additional streamlining for wetland regulations. Within the 174,115-acre plan area, the HCP/NCCP covers 8,670–11,853 acres of development and 1,126 acres of rural infrastructure projects. The HCP/NCCP requires creation of a preserve system of 23,800–30,300 acres that will be managed for the benefit of 28 covered species and their associated natural communities. The range of impacts and conservation requirements varies depending on whether the current urban limit lines of the participating cities are expanded.

The BDCP overlaps with the ECCCHCP/NCCP in the central western portion of the study area (Figure 12-3). The two plans have 15 covered species in common, including San Joaquin kit fox, western burrowing owl, and Swainson's hawk (BDCP Chapter 1, Table 1-4). While approximately 36% of the ECCC plan area overlaps with that of the BDCP (Table 12-9), the overlap area is largely cultivated land outside of the urban limit lines of the county and participating cities.

The proposed preserve system for the ECCCHCP/NCCP occurs almost entirely outside of the BDCP boundary. Construction of the water conveyance facilities would have impacts in the ECCCHCP/NCCP plan area (e.g., new forebay adjacent to Clifton Court), but not on any existing preserves. Some riparian acquisition and restoration may occur in the overlap area, particularly in the lower reaches of Marsh Creek or Kellogg Creek. Preservation and acquisition of riparian woodland and streams in the overlap area would not be likely to result in conflicts because each plan has many options for riparian restoration both inside and outside of the overlap area. These needs present an opportunity for coordination of East Contra Costa County Habitat Conservancy efforts with proposed tidal marsh restoration for the BDCP (see discussion below).

While acquisition and restoration needs of the ECCCHCP/NCCP for wetlands, grasslands, and riparian land cover are relatively low within the overlap area, all acquisition of cultivated lands will occur there (Table 12-13). Because the ECCCHCP/NCCP acquisition target for agriculture is only 400 acres, and there are more than 30,000 acres of cultivated lands within the overlap area, implementation of the BDCP is not anticipated to conflict with the ability of ECCCHCP/NCCP to meet its conservation obligations. Each plan is expected to be able to meet its conservation requirements for cultivated lands easily; together, both plans would need less than 11% of the cultivated land available at the end of the permit term of both plans once covered activities "consumption" of cultivated land is taken into account.

Below is a description of specific BDCP actions and a brief discussion of how they might affect implementation of the ECCCHCP/NCCP Conservation Strategy.

- **Permanent Surface Disturbance.** The water conveyance facilities (CM1) would be located within the ECCCHCP/NCCP area (Subzone 6d), resulting in permanent surface impacts that may remove lands available for conservation. Under all BDCP alternatives, this represents less than 3% of the total acreage within the ECCCHCP/NCCP area (Table 12-11), and land in this area is designated as having a "lower" level of acquisition effort by the ECCCHCP/NCCP, with the exception of "higher" priority acquisition lands near Byron Airport–an area where BDCP actions are not projected to occur.
- **Grasslands and Vernal Pools Restoration**. The northwest portion of CZ 8 of the BDCP overlaps with the southeast corner of the ECCCHCP/NCCP Acquisition Analysis Zone 6 (Figure 12-3). Implementation of CM3 would secure and protect at least 1,000 acres of grassland and 1,000 acres of wetlands (i.e., vernal pools and alkali seasonal wetland) within CZ 8. Within Acquisition Analysis Zone 6, ECCCHCP/NCCP intends to acquire 250–400 acres of agriculture, 100–300 acres of grassland (i.e., alkali grasslands) and 20–40 acres of wetlands (i.e., alkali wetlands). Because more than half of BDCP CZ 8 lies outside of the ECCCHCP/NCCP, implementation of the BDCP conservation strategy is not likely to preclude any grassland or wetland acquisition and restoration for the ECCCHCP/NCP. Grassland restoration is also targeted in BDCP CM8. Some of this restoration could take place in the southeast portion of the ECCCHCP/NCCP around Byron Airport. The ECCCHCP/NCCP does not target a specific acreage of grassland restoration, but does target lands surrounding Byron Airport for preservation. However, the BDCP area overlaps with a relatively small proportion of the total amount of grassland in ECCCHCP/NCCP area (Table 12-13).
- **Restoration of Dutch Slough**. BDCP CM4 identifies Dutch Slough, located with the ECCCHCP/NCCP area, as an area suitable for restoration, as does the ECCCHCP/NCCP. However, the BDCP targets tidal areas for restoration or acquisition while the ECCCHCP/NCCP targets riparian and stream communities, creating an opportunity for restoration synergies in streams, riparian, and tidal areas, including in Dutch Slough.

- **Riparian Habitat Restoration**. BDCP CM7 proposes 5,000 acres of riparian forest and scrub protection, a portion of which may occur in CZs 6 and 8, which overlap with the ECCCHCP/NCCP area (Figure 12-4). Table 12-13 indicates a moderate amount of overlap in riparian land cover targeted for preservation, but little relative to the amount existing in the ECCCHCP/NCCP area (less than 10%). Based on the proportion of overlap between the two plans, Table 12-22 indicates a relatively small area of potential overlap for riparian restoration priorities.

San Joaquin County Multi-Species Habitat Conservation and Open Space Plan

The SJCMSHCP was permitted in 2000 and is administered by the San Joaquin Council of Governments. This 50-year plan addresses 97 special-status plant, fish and wildlife species (47 of which are on the federal permit) throughout most of San Joaquin County (more than 900,000 acres), including a substantial portion of the eastern Delta. The plan participants include the County of San Joaquin and the cities of Stockton, Lodi, Manteca, Tracy, Ripon, Escalon and Lathrop. Activities covered under the plan include urban development, mining, expansion of existing urban boundaries, nonagricultural activities occurring outside of urban boundaries, levee maintenance undertaken by the San Joaquin Area Flood Control Agency, transportation projects, school expansions, nonfederal flood control projects, new parks and trails, maintenance of existing facilities for non-federal irrigation district projects, utility installation, maintenance activities, managing preserves, and similar public agency projects.

The study area overlaps a substantial portion (almost 35%) of the SJCMSHCP (Figure 12-3), which itself overlaps approximately half of the legal Delta. The plans have 39 covered species in common, including San Joaquin kit fox, western burrowing owl, giant garter snake, and Swainson's hawk (BDCP Table 1-4). Within the overlapping area, the SJCMSHCP targets for acquisition include flooded fields, grasslands, riparian woodland, row and field crops, and wetlands. The potential exists for competition for restoration sites and land acquisition in these land cover types. BDCP proposes to acquire and restore freshwater tidal, seasonal floodplains, riparian forest, grassland, and nontidal marsh in portions of the overlapping area. However, because the acquisition and restoration requirements of the SJCMSHCP are based upon mitigation ratios applicable to the natural community types where impacts occur, and the plan operates on a "pay-as-you-go" basis, the acquisition targets depend on the amount and location of impacts occurring within the county. In the 11 years of plan implementation, the vast majority of impacts and, consequently, preservation and creation efforts have occurred on cultivated land. The mitigation needs for other community types, including wetlands and riparian areas, have been minimal (Tables 12-26 and 12-27). There have been almost no impacts to wetlands in the SJCMSHCP since its inception. Most of the impacts with San Joaquin County occur on cultivated land; therefore, this land cover type has the greatest potential for competition with BDCP. A more detailed assessment is provided below for each natural community type.

Table 12-26. SJCMSHCP Preserve Acreages by SJCMSHCP Zone with Overlap of BDCP

Habitat Type	Central	Delta	Vernal Pool	Total
Wetlands	–	–	6.00	6.00
Agricultural	2,036.70	1,837.20	–	3,873.90
Agricultural and Grassland	360.00	–	–	360.00
Natural[a]	27.00	–	–	27.00
Total	**2,423.70**	**1,837.20**	**6.00**	**4,260.90**

[a] This table includes preserves in the entirety of all SJCMSHCP Zones, regardless of the proportion of each Zone that overlaps with BDCP. The SJCMSHCP 2010 Annual Report does not identify specific habitat types within preserves. Natural Habitat Lands are lands which "retain natural vegetation and are not irrigated or cultivated agricultural lands."

Table 12-27. SJCMSHCP Mitigation (acres) Owed from Existing Impacts by Habitat Type as of 2010

Habitat Type	Central	Central/Southwest	Delta	Vernal Pool	Total
Wetlands	–	15.27	–	–	15.27
Tidal	0.07	–	–	–	0.07
Riparian	–	–	–	–	0.00
Agriculture	1,948.28	1,087.33[a]	9.44	–	1,957.72
Grassland	17.21	–	–	0.85	18.06
Streams	66.13	50.46	–	–	116.59
Total	**2,031.69**	**65.73**	**9.44**	**0.85**	**2,107.71**

[a] The SJCMSHCP was partially through the easement acquisition process for a large grassland preserve of approximately 1,095 acres to close in 2011 which would negate the row and field crop mitigation acreage required in the Central/Southwest Zone.

Below is a description of specific BDCP actions and a discussion of their effects on implementation of the SJCMSHCP.

- **Permanent Surface Disturbance and Connectivity.** Under CM1, construction of water conveyance facilities located in the SJCMSHCP area would result in permanent surface impact that would remove between 6 acres and 14,050 acres of land available for conservation (Table 12-11). However, under all BDCP alternatives, this land represents less than 1.6 % of the total SJCMSHCP area (Table 12-11). Above-ground conveyance would permanently impact habitat connectivity for less mobile species. Although the eastern alignment (Alternative 1B) would not affect known occurrences of giant garter snake in San Joaquin County, it would adversely affect the giant garter snake population in the vicinity of White Slough in San Joaquin County by impairing habitat connectivity in this area: this could affect the ability for SJCMSHCP to achieve its conservation goals for giant garter snake.
- **Cultivated Lands Preservation.** The southern portion of the BDCP, including almost all of CZ 7, the eastern portions of CZs 5, 6, and 8, and the southern portion of CZ 4, overlaps the SJCMSHCP area (Figure 12-4). There is an estimated 218,370 acres of cultivated land in the overlap area that is not protected (Tables 12-18 through 12-21). Of this total, approximately 16,770 acres would be lost to covered activities planned by the SJCMSHCP and 32,580 acres expected under Alternatives 1A, 2A and 6A. BDCP effects on cultivated lands would result primarily from

construction of the water facilities and restoration of tidal wetlands and floodplains in the South Delta and Cosumnes-Mokelumne ROAs. The SJCMSHCP needs approximately 14,487–36,382 acres of cultivated land acquisition to mitigate for the remaining impacts under that plan, or 9%–22% of the total remaining. BDCP would need between 7,400–12,987 acres of acquisition in the overlap area (4%–8% of the total), depending on the habitat values of the cultivated land lost to covered activities. At the end of the permit terms, there would be an estimated 169,000 acres of cultivated land available for preservation. The combined preservation needs of the SJCMSHCP and the BDCP in the overlap area is between 21,887 and 49,369 acres, or 13%–30% of the total cultivated lands available for preservation. The Delta Wetlands Project (Delta Wetlands Project 2010), a water supply and habitat restoration project that is independent of SJMSHCP and BDCP, will require an additional estimated 20,000 acres of cultivated lands (11,000 acres for water storage and 9,000 acres of conservation easements to offset the loss of cultivated lands) within the overlap area: this would reduce the amount of lands available for preservation to 149,000. With implementation of the Delta Wetlands project, the preservation needs in the overlap area for the SJCMSHCP and the BDCP would still constitute only 15%-33% of the total cultivated lands available for preservation. This analysis demonstrates that enough cultivated lands would remain to meet the conservation and mitigation needs of both plans, even after full implementation of covered activities. In reality, preservation would occur gradually over time, prior to full implementation of all covered activities. Nonetheless, this analysis provides a conservative assessment of the potential for conflict between BDCP and the SJCMSHCP with respect to conservation and mitigation of cultivated lands. The east alignment (Alternatives 1B, 2B, and 6B) of the proposed water conveyance system poses potential impacts to the 783-acre East and West Nuss cultivated land preserves in the SJCMSHCP. However, these impacts would be temporal in nature because the impacted area would be restored to pre-existing baseline conditions following the construction of the water conveyance facilities. Loss of cultivated lands habitat from the construction of the water conveyance facilities would have a less-than-significant impact on agriculturally-dependent species, such as Swainson's hawk, because the enhancement and management of 8,000 acres of cultivated lands as foraging habitat for Swainson's hawk distributed throughout Conservation Zones 1, 2, 3, 4, and 7 of the BDCP would provide ample foraging habitat for these species in the long term. Additionally, if the East Alignment alternative is chosen as the preferred alternative, the BDCP Implementation Office would pursue a temporary conservation easement over the affected preserve that would extend for the duration of the construction and restoration activities.

Each plan is expected to be able to meet its conservation requirements for cultivated lands easily; together, both plans would need less than 30% of the cultivated land available at the end of the permit term of both plans once covered activities "consumption" of cultivated land is taken into account.

- **Tidal Wetland Restoration.** There is a large amount of overlap between the SJCMSHCP and BDCP in tidal areas (Table 12-14). The SJCMSHCP does not include any requirements for tidal wetland preservation or restoration, so there would be no direct conflicts with BDCP on these targets. However, BDCP proposes to convert an estimated 2,200 acres of cultivated land to tidal wetlands. Under Alternative 5, tidal habitat restoration would be reduced from 65,000 acres to 25,000 acres, which would not meet the BDCP restoration target for this natural community type. As a result, the extent to which the BDCP would support the recovery and long-term survival of the covered species that depend on these habitats would be substantially reduced compared with other BDCP alternatives.

The tidal restoration proposed in the South Delta ROA (CZ 7) has the potential to conflict with the existing 300-acre Ishizuka Preserve in the SJCMSHCP. In addition, tidal restoration proposed in the Cosumnes/Mokelumne ROA (CZ 4) has potential to conflict with the existing 350-acre Wing Levee Road preserve in the SJCMSHCP. These preserves provides protection for cultivated lands which the BDCP may convert to tidal natural communities. If tidal restoration occurs on one of these sites (or any other owned by the SJCMSHCP), the BDCP Implementation Office would provide compensation to property owners for the conversion of existing land use and the associated economic losses. Additionally, the BDCP Implementation Office would coordinate with SJMSHCP to identify and acquire lands of equal or greater biological value to replace the conservation needs for SJCMSHCP, as described in BDCP Chapter 3, Section 3.4.3, *Conservation Measure 3*. Mitigation Measure AG-1 requires the BDCP Implementation Office to develop an Agricultural Lands Stewardship Plan (ALSP) to preserve agricultural productivity of Important Farmland and land subject to Williamson Act contracts and to compensate off-site. In addition to Mitigation Measure AG-1, as discussed above in the cultivated land preservation section, the enhancement and management of 8,000 acres of cultivated lands as foraging habitat for Swainson's hawk distributed throughout Conservation Zones 1, 2, 3, 4, and 7 of the BDCP would provide ample foraging habitat for these species in the long term. Additional tidal restoration is targeted in the South Delta ROA (at least 5,000 acres) and the Cosumnes-Mokelumne ROA (up to 1,500 acres). All of the South Delta ROA and approximately half of the Cosumnes-Mokelumne ROA are within the SJCMSHCP plan area.

- **Riparian Preservation and Restoration.** BDCP proposes to acquire 750 acres of riparian natural community in CZ 7 under CM7. In addition, BDCP would restore at least 5,000 acres of riparian woodland and forest in the Plan Area. Approximately 40–50% of the acquisition and restoration of riparian woodland and forest is expected to occur in the overlap area of San Joaquin County (i.e., up to 375 acres of preservation and 2,500 acres of restoration). The majority of the restoration would occur on cultivated lands.

  The SJCMSHCP has an estimated need of 992 acres of riparian woodland preservation in the overlap area (Table 12-14) and 25 acres of riparian restoration if all impacts to this community occur. The SJCMSHCP permits allow removal of up to 750 acres of riparian woodland in San Joaquin County, most of which would occur in the study area (Table 12-23). There are an estimated 17,930 acres of riparian woodland and forest in the study area and approximately 8,070 acres in the overlap area. This amount is enough to meet the riparian preservation and impact needs of both plans.

- **Floodplain Restoration.** The SJCMSHCP does not require restoration of floodplains so would not conflict with BDCP in this restoration action. In BDCP, CM5 calls for restoration of 10,000 acres of seasonally inundated floodplains. Under Alternative 7, seasonally inundated floodplain restoration would be increased from 10,000 acres to 20,000 acres, which would increase costs and reduce the practicability of the conservation strategy, but would increase benefits to some covered species. Floodplains would be created by breaching and/or setting back existing levees and seasonally flooding cultivated lands, similar to what is done now in the Yolo Bypass. In this situation, cultivated lands continue to produce food but the periodic flooding limits the suitable crop types and the duration of the growing season. CM5 identifies the most promising opportunities for large-scale floodplain restoration as being in the south Delta along the San Joaquin, Old, and Middle Rivers all of which are located within the SJCMSHCP area. Therefore, this action would cause the loss or degradation of cultivated lands within the restored floodplains. The amount of cultivated land affected is estimated at 7,750–9,100 acres. This represents less than 2% of the total cultivated lands available for preservation within the SJCMSHCP area.

- **Channel Margin Enhancement.** Channel margin enhancement (CM6) would be performed along the Sacramento River between Freeport and Walnut Grove, and along the San Joaquin River between Vernalis and Mossdale, which lies within the SJCMSHCP area. Under Alternative 7, channel margin enhancement would be increased from 20 linear miles to 40 linear miles. This alternative would increase costs and reduce the practicability of the conservation strategy, but would increase benefits to some covered species. However, channel margin enhancements are not likely to conflict with SJCMSHCP conservation requirements. These actions are not likely to convert a substantial amount of agricultural land, and the SJCMSHCP is unlikely to need large amounts of riparian or channel margin habitat to meet its mitigation requirements because of the limited impacts to this land cover type in the county.

- **Grassland Preservation and Restoration.** The BDCP target of 8,000 acres of grassland preservation would occur in CZ 1 and 8, outside of the SJCMSHCP area. The SJCMSHCP plan also has substantial grassland preservation needs but these would be met largely in the inner Coast Range in southwestern San Joaquin County, outside of the study area (San Joaquin Council of Governments 2010).

  lThe BDCP may restore a portion of its target of 2,000 acres of grassland (CM8) in the western portion of the SJCMSHCP area, primarily from existing degraded grasslands. The SJCMSHCP does not specifically target grassland for restoration. However, based on the limited proportion of grassland overlap between the plans (Table 12-14), potential conflicts in acquisition or restoration targets are minimal.

- **Nontidal Marsh Restoration.** CM10 of the BDCP targets 400 acres of nontidal marsh for restoration, a portion of which could occur adjacent to habitat occupied by the Coldani Marsh/White Slough giant garter snake population in CZ 4 within the SJCMSHCP area. However, the proposed restoration would be designed to meet the conservation goals of each plan for giant garter snake and Swainson's hawk. This conservation measure is likely to provide a mutual benefit to both plans, as the SJCMSHCP specifies avoidance for known giant garter snake habitat.

East Alameda County Conservation Strategy

EACCS provides a mechanism for endangered species permitting under CESA and ESA within 271,485 acres of eastern Alameda County. The Conservation Strategy does not directly result in permits for any participating local agency but provides a framework for endangered species permitting of projects in the study area. The strategy was completed in early 2011 and is currently being utilized by local jurisdictions. The plan was prepared by Alameda County; the cities of Dublin, Livermore, and Pleasanton; Alameda County Waste Management Authority; the Alameda County Congestion Management Agency; East Bay Regional Parks District; the Alameda County Resource Conservation Service; the Natural Resource Conservation Service and in consultation with the USFWS, CDFW, and the San Francisco Regional Water Quality Control Board. The conservation strategy addresses the conservation needs of 19 species, including eight species that overlap with the BDCP (BDCP Table 1-4). In June 2012, USFWS issued a programmatic Section 7 Biological Opinion with the USACE that can be used for Clean Water Act Section 404 compliance using the framework of the conservation strategy for federally-listed species.

Only a small portion of the northeastern corner of the EACCS study area overlaps with the study area (less than 2%) and the overlap occurs in one conservation zone only (zone 7 of the EACCS). There is little anticipated urban development in that area that would be permitted using the strategy guidelines, due in part to Alameda County Measure D, which does not allow for growth outside of the existing urban limit line for the county. However, several large commercial solar energy facilities have been proposed in the overlap area. Despite this, it is unlikely that BDCP implementation would negatively affect any of the provisions associated with EACCS or vice-versa.

Below is a description of specific BDCP activities and a brief discussion of the overlap with EACCS:

- **Permanent Surface Impacts.** A small portion of the water conveyance facilities may be located in the EACCS area, resulting in permanent surface impacts of up to 4,755 acres that would remove lands available for conservation (Table 12-11). However, under all BDCP alternatives, this land only represents 2.73% of the total EACCS area.
- **Restoration and Acquisition Overall.** CZ 8 of the BDCP intersects with Conservation Zone 7 of the EACCS. Within BDCP CZ 8 (Figure 12-3), BDCP would acquire or protect riparian forest and scrub, grassland, and vernal pool communities (CM7, CM8, and CM9, respectively). However, based on the relatively small amount of overlap between the two plans (Table 12-9), the potential for conflict is minimal.

Solano County Multi-Species Habitat Conservation Plan

The Solano County Water Agency is developing the Solano County MSHCP to support the issuance of an incidental take permit under the ESA for a period of 30 years. The plan covers activities within the Solano County Water Agency's contract service area, including the cities of Fairfield, Vacaville, Vallejo, Suisun City, the Solano Irrigation District, and the Maine Prairie Water District. The plan area also covers all of unincorporated Solano County and a small portion of Yolo County.

Primary conservation actions include preservation (primarily through avoidance), restoration, invasive species control, and improvement of water quality. The plan area covers 580,000 acres, which includes 12,000 acres of proposed development and the creation of reserve system to protect natural communities and habitat for covered species[2].

- 10, 500 to 11,500 acres of valley floor grassland and vernal pools.
- 5,700 acres of cultivated lands, 1,000 of nesting and associated foraging habitat, and 1,000 of grassland/oak savanna for Swainson's hawk and burrowing owls.
- 3,300 acres of upland habitat for the California red-legged frog and callippe silverspot butterfly.
- 50 acres of riparian woodland.
- 36 acres of freshwater marsh, pond, and seasonal wetlands.

The two plans share 29 covered species (BDCP Table 1-4), including Swainson's hawk, California clapper rail, and salt marsh harvest mouse.

The Solano County MSHCP overlaps substantially with the study area in Suisun Marsh and Cache Slough (Figure 12-2) including the entirety of BDCP CZs 1 and 11, the southern portions of CZs 2 and 3, and a small, western portion of CZ 5. Most of the overlap area occurs within the Suisun Marsh and

[2] Conservation targets for the Solano HCP are based on a June 2011 working draft plan and are therefore preliminary.

Cache Slough, which the BDCP identifies as restoration opportunity areas. The Solano County MSHCP identifies providing additional funding for management and restoration of Suisun Marsh and the Delta as one of its main objectives. The areas of overlap, therefore, are likely to represent opportunities for collaboration, based upon like objectives between BDCP and Solano County MSHCP. Below is a description of specific BDCP action and a discussion of how they might affect the Solano County MSHCP.

- **Floodplain Restoration.** The BDCP proposes to increase the frequency, duration, and magnitude of floodplain inundation in the Yolo Bypass (CM2). This would restore habitat in the Suisun Marsh and Cache Slough and bays downstream of the bypass that overlap with the Solano County MSHCP area. Restoration targets for wetlands and tidal communities would be designed to benefit covered species in common with both plans such as the giant garter snake.
- **Wetlands and Vernal Pools Restoration.** Within CZs 1 and 11, the BDCP intends to protect a portion of the 600 acres of existing vernal pool complex in the Jepson-Prairie core vernal pool recovery area (U.S. Fish and Wildlife Service 2005), a portion of the 400 acres of existing alkali seasonal wetland complex, and at least 1,000 acres of existing grassland, which may include vernal pool complex and several occurrences of covered plant species (see Table 12-15 for summary of wetland acquisition). The BDCP proposes no net loss of vernal pool acreage, and a portion of proposed restoration and acquisition which would occur in CZ 1 and/or CZ 11, both of which overlap with the Solano County MSHCP plan area. The Solano County MSHCP does identify acreage targets for wetlands restoration (Table 12-15), including vernal pools. However, all of the vernal pool acquisition and restoration needs of the Solano County MSHCP will be acquired from existing commercial mitigation banks that have adequate capacity to meet the requirements of the Plan. Therefore, BDCP wetland preservation and restoration is not expected to conflict with the Solano County MSHCP.
- **Cultivated Lands Preservation.** The cultivated land acquisition target for the Solano County MSHCP is 5,700 acres of agricultural foraging habitat for Swainson's hawk and burrowing owl. Most of the cultivated land preservation will take place in the northern or northeastern portion of the county (near Dixon Ridge), which is outside of the study area. These areas have been selected for preservation because they are cultivated with crops such as alfalfa, which is preferred by Swainson's hawk as foraging habitat for. The BDCP may also maintain a portion of non-rice agriculture as foraging habitat for Swainson's Hawk in CZs 1, 2, and 3, all three of which overlap with the Solano County MSHCP (Figure 12-3). However, based on emphasis of the Solano County MSHCP to preserve cultivated lands in the northern portion of the county, outside of the areas where the Plans overlap, there is limited potential for conflicting acquisition and restoration priorities.
- **Tidal Habitat Restoration.** The BDCP identifies the Cache Slough ROA as a substantial area of land with elevations suitable for freshwater tidal natural community restoration (CM4). Almost all of the Cache Slough ROA occurs in Solano County. This would result in the conversion of approximately 5,000 to 7,000 cultivated lands to tidal natural communities. As described above, neither the loss of cultivated land or the creation of tidal natural communities is expected to conflict with the Solano County MSHCP conservation strategy, because the Cache Slough area is only targeted for conservation by BDCP. The Solano County MSHCP targets 75–100 acres of tidal habitat (coastal marsh habitat) for restoration (Table 12-15), with more than 50,000 acres available in the overlap area. Consequently, there is minimal potential for conflicting acquisition and restoration priorities.

South Sacramento Habitat Conservation Plan

The proposed South Sacramento HCP would address issues related to species conservation, agricultural protection, and urban development in 341,000 acres of south Sacramento County. The plan is being prepared by Sacramento County; the cities of Sacramento, Elk Grove, Galt, and Rancho Cordova; Sacramento Regional County Sanitation District; and the Capital Southeast Connector Joint Powers Authority. The HCP would cover 30 species of plants and wildlife, including 10 that are state- or federally listed as threatened or endangered. The western extent of the South Sacramento HCP plan area, approximately 11%, overlaps the study area Conservation Zone 4 (Figure 12-3). Included in the overlap is a portion of the South Sacramento HCP's Urban Development Area. Sixteen species are covered by both plans, including greater sandhill crane, Swainson's hawk, and giant garter snake (BDCP Table 1-4).

The South Sacramento HCP, over its permit term, intends to conserve at least 41,923 acres, most of which would be agricultural and grassland land cover types with limited overlap with the BDCP (Table 12-9). The South Sacramento HCP also intends to restore 1,786 acres, most of which would be wetland and riparian land cover types. Most of the preservation and restoration would be directed towards Primary Conservation Zones identified by the plan. Small portions of the Primary Conservations Zones for valley elderberry longhorn beetle, California tiger salamander, giant garter snake, and western burrowing owl, and most of the Primary Conservation Zone for Swainson's hawk overlap with BDCP. In these areas, the potential for conflict in acquisition efforts between the plans would be greatest, but so would the potential for restoration collaboration, especially in regards to freshwater marsh and giant garter snake habitat.

The South Sacramento HCP aims to preserve mostly grassland, by a ratio of more than 2:1 relative to other land cover types, and the BDCP does not target grassland preservation in CZ 4, thereby limiting the amount of potential conflict between the two plans overall. Approximately 41% (20,041 of 48,832 acres) of CZ 4 consists of existing protected lands, so there are ample opportunities in this zone to link the reserve system with existing open space. Stone Lakes National Refuge Wildlife Refuge and Cosumnes Preserve occupy a majority of the land in the northern half of CZ 4, which signifies less private land ownership and potential conflicts in meeting the preservation targets of both plans. The BDCP Implementing Office would protect a corridor that would be composed of contiguous patches of agricultural, restored tidal, and nontidal wetlands, grassland, vernal pool complex, and other seasonal wetlands. This corridor would extend from the Caldoni Marsh/White Slough giant garter snake subpopulation area north to Stone Lakes National Wildlife Refuge, and to the extent possible would also connect to the Cosumnes River Preserve. The corridor would be configured to provide a giant garter snake movement habitat along this north-south corridor. Tables 12-16, 12-18 through 12-21 and 12-25 summarize potential overlap in acquisition and restoration targets, respectively.

- **Permanent Surface Disturbance**. The construction of the water conveyance facilities poses the greatest permanent surface impacts to the South Sacramento HCP area (up to 3,988 acres under the eastern alignment). However, because of the limited geographic overlap between the two plans, and the Sacramento HCP's emphasis on acquisition of grassland, which is ample in the South Sacramento HCP overall area (more than 175,000 acres available), there is limited potential for conflicting acquisition priorities. Under CM1, construction of the water conveyance facilities located in the South Sacramento HCP would result in permanent surface impacts that would remove between 150 acres and 3,998 acres of land available for conservation (Table 12-

11). However, under all BDCP alternatives this represents less than 1.1 % of the total South Sacramento HCP area (Table 12-11).

- **Cultivated Lands Preservation.** The northeastern portion of the BDCP, including over half of CZ 4 and the northern portion of CZ 5 (Figure 12-3). There is an estimated 17,583 acres of cultivated land in the overlap area that is not protected (Tables 12-18 through 12-21). Of this total, approximately 1,900 acres would be lost to covered activities planned by the South Sacramento HCP and 3,556 acres expected under the BDCP. The water conveyance facilities footprint impacts are the among the largest in the South Sacramento HCP area. BDCP impacts to cultivated lands would occur primarily from construction of the water facilities and restoration of tidal wetlands and floodplains in the Cosumnes-Mokelumne ROA. After subtracting all the remaining impacts assumed from both plans, there would be an estimated 13,181 acres available for preservation. The combined preservation needs of the South Sacramento HCP and the BDCP in the overlap area is between 3,341 and 13,090 acres, or 25–99% of the total cultivated lands available for preservation. If all the preservation needs of both plans were to be acquired in the overlap area, there is potential for conflict in meeting the acquisition targets of both plans. Alternative 1B poses the greatest impacts to the South Sacramento HCP overlap area (4,024 acres), and could present conflicts in achieving cultivated land preservation targets for both plans in the overlap area (Table 12-19). However, as discussed above, there is an estimated 60,000 acres of cultivated land remaining for preservation in the South Sacramento HCP area that does not overlap with the BDCP study area, so both plans would easily be able to achieve their cultivated land preservation targets. As described in BDCP Section 3.4.3, *Conservation Measure 3*, if during the permit terms of the overlapping plans, the South Sacramento HCP is unable to meet its mitigation requirements due to a lack of willing sellers and due in part to acquisition by BDCP in the overlap area, a credit swap of easement(s) would be initiated. Determination that this criterion has been met would be made jointly by CDFW, USFWS, the BDCP Implementation Office, and the South Sacramento HCP implementing entity. Land owned by the BDCP Authorized Entities or Supporting Partners in the overlap area in fee title or conservation easements would be identified for their applicability to the South Sacramento HCP conservation strategy. The South Sacramento HCP would acquire conservation easements or fee title on land outside of the overlap area with equivalent or greater conservation value to BDCP as the land identified in the criteria above. This land acquired would be within the BDCP Plan Area but could be outside Sacramento County. As an alternative, the BDCP Authorized Entities or Supporting Partners could acquire the additional lands with funds from the South Sacramento HCP. Once the additional land is acquired outside of the overlap area, the BDCP land within the overlap area would be transferred in fee title or conservation easement holder to the South Sacramento HCP. The land acquired by the South Sacramento HCP outside of the plan area with equivalent or greater conservation value to BDCP would be transferred to a BDCP Authorized Entity or Supporting Partner. Once the transfers are complete, the credit assigned to each plan for the conserved land would also be transferred. BDCP would ultimately acquire no more than 3,000 acres in the overlap area with South Sacramento HCP.

- **Tidal Habitat Restoration.** Approximately half of the proposed 3,072 acre Cosumnes Mokelumne ROA overlaps with the South Sacramento HCP, resulting in an estimated 1,535 acres of cultivated land converted into tidal natural communities. However, as discussed above, both plans would easily achieve their cultivated lands preservation targets through the implementation of MM AG-1 and the preservation of cultivated lands in the South Sacramento HCP area that does not overlap with the BDCP study area.

- **Nontidal Marsh Restoration.** The South Sacramento HCP proposes to restore 600 acres of nontidal wetland habitat in Caldoni Marsh/ White Slough, which overlaps with the CZ 4 of the BDCP. The BDCP proposes 200 acres of nontidal restoration in CZ 4. In total, the two plans propose to convert 800 acres of the approximately 1,700 available acres of cultivated land in the overlap area to nontidal wetland natural communities. This represents less than half of the total cultivated land available in the overlap area and as such both plans would be able to meet their restoration targets in this area. CZ 4 of the BDCP contains the Caldoni Marsh/White Slough subpopulation of giant garter snake, providing opportunities for joint preservation of agricultural land and restoration of nontidal and riparian habitats to protect and expand this subpopulation and create habitat connectivity with the giant garter snakes in the Stone Lakes area.
- **Wetlands and Vernal Pools Restoration.** The BDCP proposes to protect 600 acres of existing vernal pool habitat and 400 acres of existing alkalai seasonal wetland complex, with the majority of the preservation occurring in CZ 1, 8, and 11. The South Sacramento HCP proposes to preserve a total of 1,048 acres of vernal pool, or vernal impoundment and 170 acres of vernal swale in a matrix of valley grassland, and restore a total of 363 acres of vernal pool or vernal impoundment in a matrix of valley grassland. The total preservation and restoration of vernal pools and alkalai seasonal wetlands proposed by the South Sacramento HCP is approximately 1,800 acres, or 24%, of an estimated 7,500 acres available in the South Sacramento HCP area. The BDCP does not have specific requirements for vernal pools or alkalai seasonal wetland preservation in CZ 4, so there is minimal potential for conflict in achieving the preservation targets of the South Sacramento HCP in the overlap area.

Yolo Natural Heritage Program

The Yolo County NCCP/HCP Joint Powers Authority, consisting of five local public agencies, launched the YNHP in March 2007. Member agencies are Yolo County and the cities of Davis, Woodland, West Sacramento, and Winters. In addition, a representative of University of California, Davis, serves as an ex-officio member of the Joint Powers Authority board. The YNHP covers a 653,818-acre planning area, 17% of which overlaps with the BDCP. The YNHP documents are in development. The proposed list of covered species contains 32 sensitive species in five principal natural communities. The YNHP overlaps with the BDCP in the Yolo Bypass area (CZs 2 and 3) (Figure 12-3) and has 20 species in common with the BDCP (BDCP Table 1-4). Within the overlapping area, the YNHP targets for acquisition include annual grasslands, riparian, and cultivated lands. BDCP proposes to acquire cultivated lands, acquire or restore grasslands, and restore nontidal marsh in portions of the overlapping area, primarily to benefit giant garter snake. Additionally, BDCP proposes tidal restoration in the Cache Slough ROA, which partly overlaps with the YNHP plan area. The potential exists for competition for restoration sites and land acquisition, but the overlap also creates opportunities for coordination, partnerships, and achieving common conservation goals.

Based on a simple analysis of the major natural community types for the intersecting area of the two plans (Table 12-17), there is significant overlap between tidal and wetland land cover types. In other words, most conservation targets for these land cover types in the YNHP would need to be addressed within the overlap area. However, the overlap area has more than 10,000 acres of mapped wetland available for acquisition or restoration and almost 5,000 acres of tidal land cover type. BDCP CM4 would restore or create at least 24,000 acres of tidal freshwater emergent wetland, a portion of which would be located in CZ 2 (within the overlap area). The BDCP targets 600 acres of nontidal marsh restoration (crosswalked to “wetlands” in this analysis), 200 acres of grassland protection or restoration, and 700 acres of cultivated lands protection within or adjacent to habitat occupied by the giant garter snake Yolo/Willow Slough subpopulation in CZ 2, entirely within Yolo County. The YNHP also has conservation targets for giant garter snakes in this subpopulation, but it is focused in the YNHP Willow Slough Basin Planning Unit, only a small portion of which overlaps with the BDCP Plan Area. The two plans could work together to jointly achieve conservation for giant garter snake in the Yolo/Willow Slough subpopulation.

Below is a description of specific BDCP actions and a brief discussion of the overlap with YNHP.

- **Permanent Surface Disturbance.** Under CM1, water conveyance facilities located in the YNHP area would result in permanent surface impacts of up to 5,834 acres under Alternative 1C that may remove lands available for conservation (Table 12-11). There would be no permanent surface impacts of the water conveyance facilities from the other BDCP alternatives.
- **Cultivated Lands Preservation.** Within CZs 2 and 3, BDCP may protect a portion of the total conservation goal of 1,000 acres of cultivated lands as foraging habitat for Swainson's hawk (CM3), thus removing it from conservation under the YNHP. There is an approximately 17,500 acres of cultivated land in the area where the BDCP overlaps with the YNHP. An estimated 6,158 acres of cultivated would be lost under CM1 in the overlap area, approximately 35% of the cultivated land available for preservation. BDCP CM4 would restore or create at least 24,000 acres of tidal freshwater emergent wetland, a portion of which would occur in CZ 2, within the overlap area.
- **Riparian Restoration.** CM7 would restore 5,000 acres of riparian forest and scrub in the BDCP Plan Area in association with restoration of tidal wetlands and floodplains. A portion of this restoration would occur in CZ 2, although most is expected to occur in CZ 7, outside the overlap area. The YNHP also has conservation targets for riparian but most of it is targeted for YNHP planning units outside the overlap area.
- **Floodplain Restoration.** Implementation of BDCP CM2 would increase the annual average inundation of the Yolo floodplain within the overlap area of the two plans. This measure would help to restore habitat in Cache Slough (a portion of which is within the YNHP area) for delta smelt, longfin smelt, and other BDCP covered fish species. The YNHP conservation strategy does not include any conservation measures within the Yolo Bypass, so an increase in inundation frequency and duration as a result of BDCP is not expected to affect the YNHP. BDCP will mitigate for any significant impacts on terrestrial species that would result from inundation.
- **Wetlands Restoration.** CM10 would restore 600 acres of nontidal marsh within or adjacent to habitat occupied by the giant garter snake Yolo/Willow Slough subpopulation in CZ 2. Approximately 58% of CZ 2 consists of protected land, and there remain ample opportunities to protect cultivated lands and associated natural communities in large blocks connected to open space. Yolo Bypass Wildlife Area and other open space lands owned by CDFW are present in the central and northern portions of CZ 2, while Liberty Island, owned by the Trust for Public Lands, and other land owners by the U.S. Army Corps of Engineers and the Bureau of Reclamation are present in the southern portion. Based on the amount of overlap between YNHP and BDCP areas (Table 12-9), there may be limited potential for conflict and possibilities for joint collaboration in restoration efforts.

Effects of Other BDCP Conservation Measures on Overlapping Conservation Plans

The BDCP contains management-based conservation measures designed to meet or contribute to the biological goals and objectives identified in BDCP Chapter 3, Section 3.3, *Biological Goals and Objectives*. Many of these conservation measures are designed to address "other stressors" of the BDCP covered fish. While many of these conservation measure are expected to occur within the overlapping conservation plans (Table 12-28), most would occur within the aquatic environment of the Delta, resulting in minimal overlap with the other conservation plans (which focus primarily on upland and terrestrial areas). Potential areas for overlap are identified in this section and are considered to be manageable and/or avoidable.

- *CM11 Natural Communities Enhancement and Management* outlines a suite of management techniques to be applied across the BDCP reserve system and for each natural community. CM11 would overlap all other conservation plans and be applied wherever BDCP acquires land for the reserve system. The management techniques described in CM11 are similar or the same as those of the other conservation plans, so management is expected to be highly compatible where conservation lands of overlapping plans occur adjacent or near to each other.
- *CM13 Invasive Aquatic Vegetation Control* would be applied in aquatic systems throughout the BDCP Plan Area, with concentrated activities expected within the five ROAs. Therefore, this conservation measure is likely to overlap with most of the other conservation plans (Table 12-28). Invasive aquatic vegetation is a serious problem identified in several other conservation plans, so this BDCP conservation measure is expected to be consistent with the other overlapping plans.
- *CM14 Stockton Deep Water Ship Channel Dissolved Oxygen Levels* would only be applied in the Stockton Deep Water Ship Channel in San Joaquin County. This measure is compatible with the goals of the SJCMSHCP, which also covers green sturgeon. This species is expected to be benefit from this conservation measure.
- *CM15 Localized Reduction of Predatory Fishes* would be applied in select locations throughout the Plan Area. The conservation measure is likely to be applied in the overlap areas of the SJCMSHCP, Yolo HCP, and South Sacramento HCP, and may be applied in the Solano HCP and ECCC HCP/NCCP. Predator control measures would not conflict with existing or planned conservation plans because they would be applied in aquatic systems only, which does not overlap with most plans. Of these plans, only the SJCMSHCP and Solano HCP cover fish also covered by BDCP.
- *CM18 Conservation Hatcheries* requires the establishment of new hatcheries, and the expansion of existing conservation propagation programs for delta and longfin smelt. CM18 would be implemented near Rio Vista in Solano County. A small amount of land would need to be acquired to build the longfin smelt hatchery. Because the planned site is already disturbed, this acquisition would not conflict with the Solano HCP.
- *CM19 Urban Stormwater Treatment*, *CM20 Recreational Users Invasive Species Program*, and *CM21 Nonproject Diversions*, would be implemented throughout the BDCP Plan Area and are likely to overlap with almost all of the other conservation plans. The exact locations of their implementation are not known because CM19 and CM21 rely on willing participants that have not been identified yet. Despite this uncertainty, these conservation measures are likely to be compatible with or at least not conflict with the other conservation plans because they are restricted to aquatic areas that are largely not addressed by the other conservation plans.

Table 12-28. Potential Occurrence of Other BDCP Conservation Measures in Overlapping Conservation Plans

BDCP Conservation Measure	ECCC HCP/NCCP	San Joaquin	EACCS	Solano MSHCP	South Sacramento HCP	YNHP
CM11 Natural Communities Enhancement and Management	Yes	Yes	Potentially	Yes	Yes	Yes
CM12 Methylmercury Management	W Delta ROA (Dutch Slough)	South Delta ROA	None	Suisun Marsh and Cache Slough ROAs	Cosumnes-Mokulemne ROA	Cache Slough ROA
CM13 Invasive Aquatic Vegetation Control	Yes	Yes	None	Yes	Yes	Yes
CM14 Stockton Deep Water Ship Channel Dissolved Oxygen Levels	None	Yes	None	None	None	None
CM15 Localized Reduction of Predatory Fishes	Potentially	Yes	None	Potentially	Yes	Yes
CM16 Nonphysical Fish Barriers	Unlikely	Yes	None	Potentially	Yes	Yes
CM17 Illegal Harvest Reduction	Potentially	Yes	None	Yes	Yes	Yes
CM18 Conservation Hatcheries	None	None	None	Yes	None	None
CM19 Urban Stormwater Treatment	Potentially	Potentially	None	Potentially	Potentially	Potentially
CM20 Recreational Users Invasive Species Program	Yes	Yes	None	Yes	Yes	Yes
CM21 Nonproject Diversions	Potentially	Potentially	None	Potentially	Potentially	Potentially

12.3.6.2 CEQA Conclusion

The BDCP overlaps geographically with six conservation plans. Impacts from construction and implementation of BDCP alternatives are not anticipated to affect implementation of the overlapping plans. Understanding whether BDCP acquisition and restoration goals would preclude the implementation of other conservation plans is more challenging. The analysis above indicates that the degree to which this competition would impact the conservation goals of other plans is limited. In most cases, because of the flexibility for acquisition targets incorporated into the BDCP and other plans, the potential conflict would be manageable, and significant conflicts with the implementation of overlapping plans could be avoided. Because the conservation strategy for the YNHP and South Sacramento HCP are not available, further analysis may be required at a later date. In certain cases, especially pertaining to similar restoration objectives, perceived conflicts may also represent opportunities for collaboration to jointly achieve similar conservation goals. Because implementing the BDCP would not result in a conflict with the provisions of an adopted HCP, NCCP or other approved local, regional or state habitat conservation plan, there would be a less-than-significant impact.

12.4 References Cited

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12.4.2 Personal Communications

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Radmacher, Richard. Director. Sacramento County Department of Water Resources. August 27, 2012—phone call to Theresa Engle, ICF International.

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